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Electronics Today INTERNATIONAL

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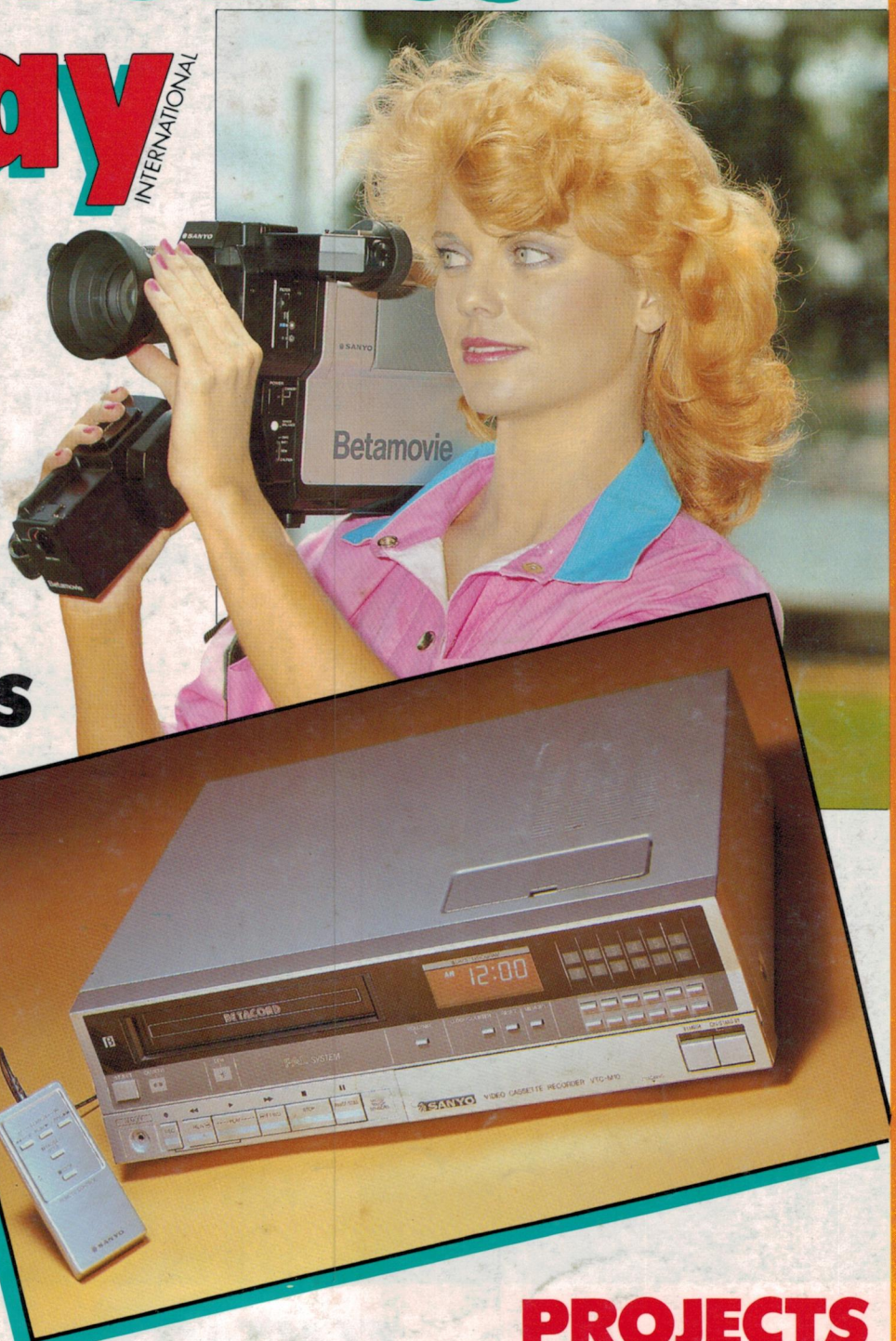

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QUICK INDEX

IT IS PROBABLY time that the magazine's background and history were explained (again) for the benefit of readers, 'old' and new alike.

Electronics Today was conceived by a 15-year-old schoolboy! Back in 1968, Kim Ryrie tried to convince his publisher father, Colin, that there was a market for an alternative to the long-established Electronics Australia (which had the market to itself, then). Collyn Rivers responded to an advertisement (in Electronics Australia!) for 'an electronics journalist' with sound practical experience (a true rarity still) and joined Modern Magazines in 1970.

Electronics Today was born on March 23, 1971. It was put together then by a staff of two — Collyn Rivers, as Editor chief-sub-layout-secretary-cleaner, and Barry Wilkinson doing the projects and drawings. Twelve months later, in 1972, a British edition was set up, followed six months later by a French edition. (This was sold to the French publishers a few years later.) In 1977, Canadian, German and Dutch editions appeared. Each is now autonomous. The word 'international' was added to the title with the launch of the British edition. Many readers have identified us as 'ETI' ever since.

A few years ago PT Centronics began publishing a series of project books in Indonesia using material from mostly the Australian editions.

Despite what some might make of the 'international' in our title, Electronics Today — this magazine you're reading, is wholly Australian owned, produced and printed. Fair dinkum!

The British, Canadian, German, Dutch — and Australian, editions all continue to flourish, despite the onslaught of a plethora of computer magazines.

Kim Ryrie, the perspicacious schoolboy, is now the Director of Fairlight Instruments, makers of the world-famous Fairlight Computer Musical Instrument.

Collyn Rivers, founder-Editor/Editorial Director/Managing Editor now runs a thriving technical writing/publishing firm with his wife, called Vernon Rivers & Associates.

Barry Wilkinson formed a company in 1976 to produce the projects for ETI and do freelance design. He gave away the ETI projects in 1978 (when we re-established our own lab.) and was recently behind the design of the Dulmont Magnum computer. At present he is 'semi-retired'.

Our current Managing Editor, Jim Rowe, as many readers will well know, is an ex-Editor of Electronics Australia. Strange, the twists of fate, eh?

Here we are, 13 years old (which event we celebrated on Friday, April 13), perhaps the *enfant terrible* of Australian electronics publishing, looking toward to a vigorous and prosperous, but *never* dull, future.

Roger Harrison
EDITOR

SERVICES

TECHNICAL INQUIRIES: We can only answer readers' technical inquiries by telephone after 4.30pm Mondays to Thursdays. The technical inquiry number is (02) 662-4267. Technical inquiries by mail must be accompanied by a stamped, self-addressed envelope. There is no charge. We can only answer queries relating to projects and articles as published. We cannot advise on modifications, other than errata or addenda. We try to answer letters as soon as possible. Difficult questions may take some time to answer.

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PROUDLY PRINTED IN AUSTRALIA

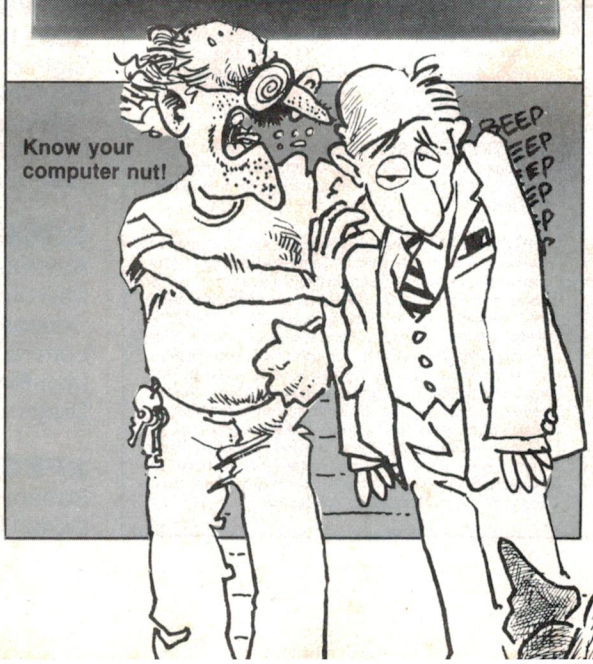
ELECTRONICS TODAY INTERNATIONAL is published monthly by the Electronics Division of the Federal Publishing Company Pty Limited, 140 Joynton Avenue, Waterloo, NSW 2017. Typeset and printed by ESN-The Litho Centre, Sydney. Distributed by Gordon and Gotch Limited, Sydney. Cover price $2.50 (maximum and recommended Australian retail price only; recommended New Zealand price, $2.95). Registered by Australia Post, Publication No NBP0407. ISSN No 0013-5216.

Perth show. Car CD players — when?

Electronic mousetrap to build!

SPECIAL OFFERS

Black Magic! The Memotech MTX500



Know your computer nut!

NEWS

COLUMNS

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This page is to assist readers in the continual search for components, kits, printed circuit boards and other parts for ETI projects and circuits. If you are looking for a particular item or project and it is not mentioned here, check with our advertisers.

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FEATURES

PROJECTS

REVIEWS

NEXT MONTH

STEREO TV SETS REVIEWED

Louis Challis reviews two top-line stereo TV receivers, from Sony and Philips. Does the news in stereo *really* grip you? Will Amanda leave John and cause Kevin to run away with Jill all in stereo? Is the French soundtrack better than the English on *Les Miserables*? Find out in the next exciting episode of *"Louis Challis Finds Out"!*

SIMPLE STEREO PROJECT

Next month we'll be describing a beaut stereo record player and amplifier system that's perfect for the beginner. Costing well under $100, including the turntable, you can build this good-looking little unit that's just great for use in the bedroom, den, etc. It uses all readily available parts and is simple to build — just the thing for a weekend project, yet doesn't look 'home-made'.

ADVERTISERS' INDEX

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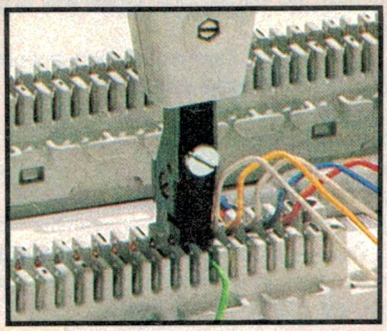

For more details of this amazing system, contact your nearest Lawrence & Hanson Sales Centre or State Technical Sales Branch.

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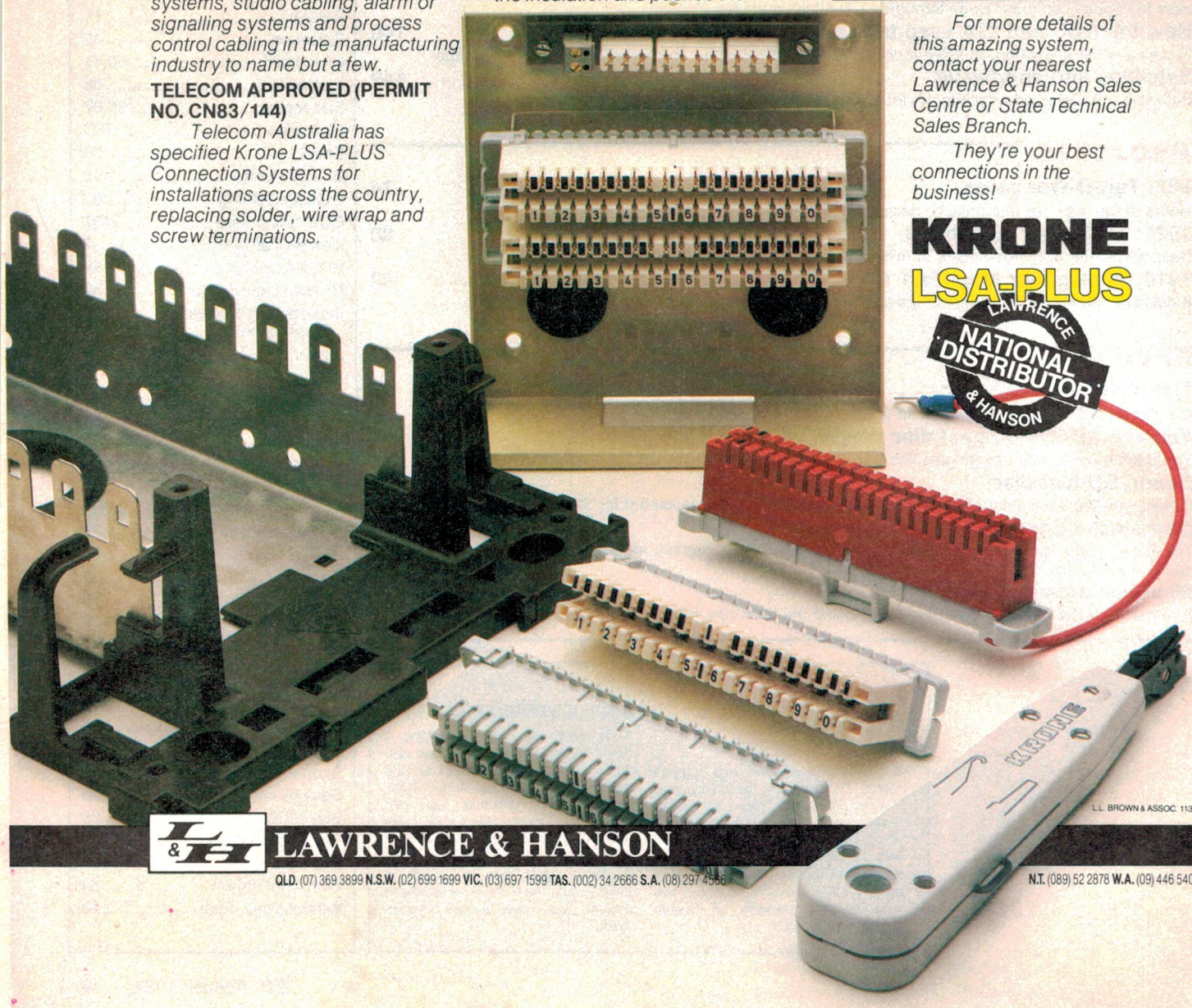

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It's the first real-time software analyser to offer detailed triggering and store qualification based on high-level statement line numbers and module names.

Virtually all high-level language compilers can interface with the HP 64620 analysis package, so it's source-language independent.

You can develop code on your favourite mainframe computer, then down load portions of the code to the HP 64000 system (with an installed HP 64620 subsystem) for detailed real-time program flow analysis.

You get the economy of mainframe time-sharing, along with the unsurpassed diagnostic, emulation, and analytical features of the HP 64000 Logic Development System.

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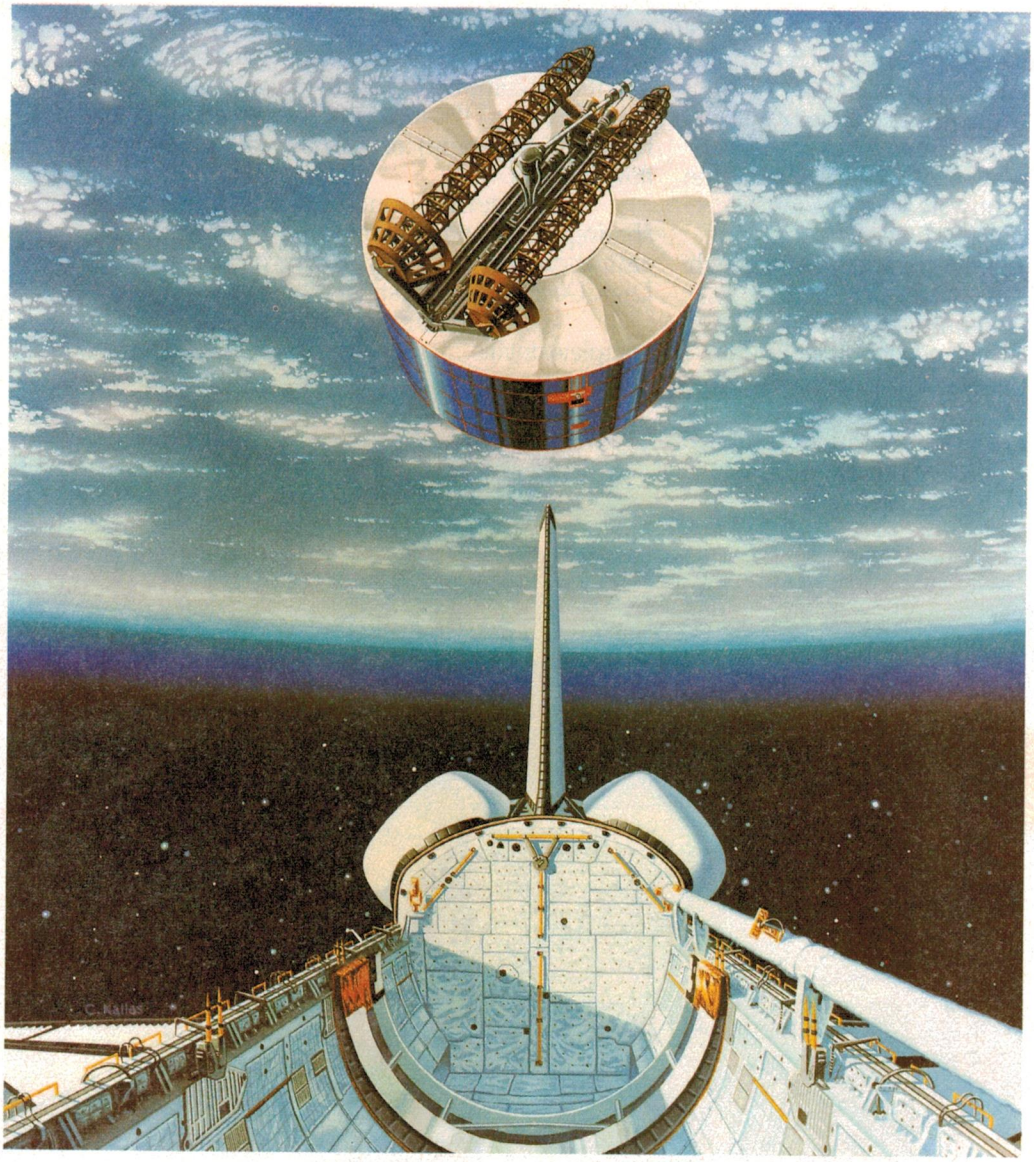

It's the "frisbee" satellite!

The world's first "frisbee" satellite was to be sent spinning into orbit from the cargo hold of the space shuttle Discovery last month. The gigantic satellite, over 4 m diameter and 6 m high, is too big to launch by conventional rocket.

Called "Leasat", the satellite is the first of four communications spacecraft for the US Navy under a lease arrangement with owner-operator Hughes Communications Services Inc., a wholly-owned subsidiary of Hughes Aircraft Company. All are scheduled for launch by the space shuttle before the end of 1985. The Leasat network will provide global communications to the US armed forces.

Because of its 4.3 metre diameter, Leasat is too large to launch on any vehicle other than the space shuttle. It is the first geosynchronous communications satellite to have its own in-built propulsion mechanism* while its compact design significantly reduces shuttle launch costs.

The 4.3 m diameter cylindrical satellite is spin-stabilised, rotating at 30 rpm when in final orbit to provide gyroscopic stability and thermal control. The spinning 'barrel' of the satellite contains the solar array (for powering the batteries), Sun and Earth sensors to keep its 'attitude' correct, plus propulsion and attitude control systems. A 'de-spun' platform contains the antennas, communications and telemetry equipment. The antennas always point Earthward.

The Leasat is placed in orbit in five stages. Carried on its side in the shuttle bay, attached to a U-shaped cradle, an explosive spring mechanism flings the Leasat from the shuttle bay with a spinning motion, like you launch a frisbee. This spins the satellite at 1.7 rpm, stabilising it and preventing solar over-exposure (i.e: sunburn). A timer puts up the bird's command and telemetry antennas and sets off a thruster which increases the spin rate to 33 rpm.

After the satellite has drifted half-way round the world at the shuttle's orbit height, a perigee 'kick' motor is set off that boosts it to a 'transfer' orbit with an apogee of 16 500 km.

Two liquid fuel motors then take the bird through three successive orbits, raising the apogee to 19 700 km, 26 000 km and finally, geosynchronous orbit over the equator at 35 800 km, after a few manouvers.

Once in place, the satellite is re-oriented, its antenna and electronics platform de-spun and the antenna deployed. The main body of the satellite spins at 30 rpm throughout its 10-year design life.

Two 3.7 m-long helical antennas provide receive and transmit capability in the UHF band from 240 to 340 MHz. Telemetry, command, and the fleet broadcast uplink and beacon are in the SHF band.

The communications subsystem consists of four functional groups: The fleet broadcast (25 kHz), wideband (500 kHz), relay (25 kHz) and narrowband (5 kHz). The fleet broadcast uses a 35 W transmitter and produces an effective isotropic radiated power (EIRP), or signal strength, of 26 dBW. The single wideband channel uses a 53 W transmitter for an EIRP of 28 dBW, and the six relay channels use 35 W transmitters for an EIRP of 26 dBW. The five narrowband channels share a 20 W transmitter for an EIRP of 16.5 dBW.

After seven years in orbit, Leasat's solar array will generate 1200 W of electrical power. Three 24 Amp-hour Nickel-Hydrogen batteries supply full power during eclipse operations when the satellite passes through the Earth's shadow for up to 72 minutes during the equinox. The redundant three-battery system permits full load support with the loss of two batteries.

World's largest telescope

The University of California announced plans to build the world's largest reflecting telescope on Mauna Kea, a 4300 metre peak in Hawaii. It will be operating by 1990, according to the university, though the design is so radical that some scientists doubt it can be done.

10 metres across, almost twice as large as any existing reflecting telescope. It will gather four times more light and survey eight times the volume of space.

Astronomers expect to see light from events that occurred up to 17 billion years ago, thereby opening up new knowledge about the origins of the Universe.

The telescope will be called the Maximillian E. and Marion Hoffman Observatory.

The telescope will not be made of one mirror, like conventional telescopes. Instead it will comprise 36 hexagonal segments arranged in a parabola. The continuous alignment of the 1.6 metre mirrors will be established by actuators and sensors controlled by a computer.

Each of the mirrors' six sides will have two sensors. The computer will interpret signals from the sensors 100 times a second and then command three motors on the back of each mirror to make any necessary minute adjustments.

Ace in the hole! Terry Evans of Ace (left) signs with Ron Parker of Fairchild.

Ace in the hole for Fairchild

Sydney-based electronic components distributor, Ace Electronics Pty Ltd, has been appointed Fairchild distributor for NSW.

This was announced recently by Mr Ron Parker, Managing Director of Fairchild Australia.

Mr Parker said that the newly-formed Ace Electronics has the financial backup to make a major, long-term contribution to the supply of components to the electronics industry.

The General Manager of Ace Electronics Mr Trevor Evans stated that the new agreement became effective 1st June and initial orders for over one million devices have been placed.

"Fairchild components will represents a large percentage of the total business activities of Ace Electronics. To fully provide the service and facilities needed to handle and satisfy customers' orders, a well-stocked warehouse and a fully computerised stock and accounting system have been installed."

He said that in the present market there was an opportunity for an aggressive, active and service-orientated company to cater for the needs of the industry.

Ace will be carrying in excess of 3000 Fairchild lines.

Ron Parker said that his company believed that Ace Electronics' policy of service, keen prices and expertise complemented their own policies and that both companies will benefit from the agreement.

Ace Electronics is located at **69-75 Reservoir St, Surry Hills NSW 2010. (02)211-1144.**

Rendezvous with Halley's Comet

Pictures from two Russian spacecraft may be used to ensure that a western European probe can get close to the core of Halley's Comet.

Halley's Comet is only seen from Earth once every 76 years. It was last seen in 1910 and is due to approach Earth again in early 1986. It has already been spotted on its orbit back towards Earth.

Russia and Japan are each planning to send up two craft to rendezvous with the comet on the night of March 13-14, 1986, and these will be joined by two others built by the US and the European Space Agency (ESA).

The $54 million ESA craft, named Giotto, is now under construction at the British Aerospace centre at Bristol in western England, and promises to be the most important and most elaborately instrumented of the six Halley probes.

Scientists predict that this craft may get as close as 500 kilometres to the Halley core as it goes through its 2000 kilometres wide dust cloud at a passing speed of 68 kilometres per second.

It may be helped by the two Russian Vega craft which will approach Halley first. They have a camera on board and the pictures could provide valuable information about Halley's exact position in space, so enabling the Giotto craft to be positioned with sufficient accuracy to get in closer to the comet than any of the others.

The 700 million kilometres journey from Earth will take eight months and Giotto's 10 experiments will have just a four-hour operational life as the craft approaches and passes Halley.

At the speed the two will pass, dust particles from the comet will present a hazard to the spacecraft and despite being protected by a shield, computer models indicate that Giotto may not survive the encounter.

Before it is destroyed, however, it is hoped that the Giotto's instruments will provide unique data on the chemical composition of the cloud of dust surrounding the comet's core, and of its tail. A camera will also take colour pictures of the surface of the comet and measurements will be made of its magnetic field. ▶

The Russians are Coming

The Museum of Victoria, Melbourne, is hosting the Soviet Space Exhibition from August 24, 1984.

The exhibition covers Soviet space achievements from the launch of Sputnik 1 through the first soft landings on Mars and Venus up to the exploits of Salyut 6.

The show will consist of replicas of most of the important space craft of the last three decades, plus some moonrock from Lunahod and a working model of the Baikonur space launching station. There will be videos and an eighty minutes film on the history of space flight.

School and students bulk bookings are available from the Education Department of the Museum. Other group bookings are available as are guided tours of the exhibition.

For more information phone the **Museum on (03) 654-3341.**

NEW FACES AT ETI

Jonathan Fairall
Technical Writer

Jon was born, raised and did various silly things while growing up in all sorts of funny places around the world. All without the slightest interest in electronics. The first thing he did when he left school was join the Navy, having grown up with visions of steaming about the world sorting out foreigners. He learned very quickly however, that ships don't paint themselves. After two years of putting grey paint on the side of a ship he very nearly went colour blind and left the service to become a layabout in Sydney. Well, a student actually.

During his years at Uni he learned his second great lesson about life, i.e: an inebriated arts student falls down just as fast as an inebriated sailor, only the student uses longer words to describe the situation.

Having learnt even more about life by driving a taxi while at Uni, he was admirably equipped to enter the glittering world of TV, where all the beautiful people work. After a while, the beautiful people turned out to be pretty ordinary workaholics who work so hard during the day they barely have the energy to crawl into bed at the end of it.

Anyway, sitting in the control room day after day as yet another show lurched calamitously to air, he became intrigued by the technology around him. So, on the basis that 'if I find it interesting someone else probably will too', he began writing science-type documentaries. It pretty soon dawned on him though, that after x million years in school and far too many at Uni, he was a real babe in the woods when it came to the things that really make the world go round.

So, always being a sucker for punishment, he started all over again with educational establishments and rediscovered that both Shaw's and Peters' dictims apply very well to our great institutions of technical education. In spite of, or because of, their best endeavors he did learn about bytes, betas and bits, and picked up a magazine called. Er, Ah, . . . ETI on the news stand.

There followed a stint with Telecom, during which he discovered why the world doesn't so much go around as lurch through bends, before being accosted by your eager Editor, who said things like: "Ve haf veys of makink you vork," and "I vill nails your hands to ze typewriter."

Somewhere along the line, and by methods still not altogether clear, he acquired offspring (I can loan you a good book, Jon . . . Jennie) and all the other paraphernalia of modern urban existence.

He likes good books and Australian movies (some of them, anyway), bushwalking, astronomy and music. He hates commercial TV and agrees totally with Oscar Wilde who once (more-or-less) said that anyone who opens his mouth before ten in the morning is a blithering idiot.

.....Brits follow later

Britain will be a key participant in IREECON '85, the 20th International Convention and Exhibition held by The Institution of Radio and Electronics Engineers Australia (IREE Aust).

This is the first time overseas exhibitors will be represented as a group with government backing, which reflects the rapidly growing international interest in IREE's biennial event.

From a small beginning in 1938, IREE Conventions have expanded to become Australia's largest and most comprehensive exhibition of professional electronic equipment, uniquely providing both a showcase for the latest electronic machinery and a meeting place for leading scientific minds.

IREECON '85 will take place in Melbourne's Royal Exhibition Building from September 30 to October 4 next year. Bookings and inquiries indicate that the number of exhibitors will exceed the record established last year at IREECON '83, which was held in Sydney at the Royal Agricultural Society Showground. The organisers also expect a record number of technical papers for the concurrent lecture program.

The theme for IREECON '85 is: "The Australian position in the new era of communications".

IREECON '83 saw the first team of government-backed exhibitors, when representatives of Western Australian industry participated with the support of the Western Australian Government through the Department of Industrial Development.

Other states are understood to be studying the possibility of a similar arrangement at IREECON '85 and it is thought that Britain's decision to provide support for an industrial group could prompt other countries to follow suit.

IREECON '85 will feature a number of guest speakers complementing technical papers on a broad range of subjects.

For further information contact **Heather Harriman, Executive Officer, The Institution of Radio and Electronics Engineers Australia. (02) 29-4051.**

IEEE centennial medals

In celebration of its Centennial Year, the US-based Institute of Electrical and Electronics Engineers (IEEE) has awarded 1984 centennial medals, world wide, to outstanding individuals in recognition of their exceptional service to the Institute and to the profession.

Eight Australians have been chosen to receive this award.

They are: Ian P. Bates, of the State Electricity Commission of Victoria, for his contribution to control electric power systems, Professor Lou Davies of AWA, for research into solid state electronics, Dr Bob Frater, of the CSIRO for work on signal processing, Professor Doug Lampard and Professor Hugo Messerle for contributions in education, Walter Samlo of the CSIRO for contributions to microwave measurement, Sir William Tyree for services to heavy electrical engineering and Jim Vasseleu of Power Electronics for leadership of the IEEE in Australasia.

Electronics & automation Trade Fair

The Electronics and Automation Trade Fair will be held in Oslo, Norway, 9-13 October, 1984.

This year's fair offers an extensive range of specialised, yet interacting, products and services. Exhibitors will be invited from the fields of hydraulics and pneumatics, process control and monitoring, control engineering, instrumentation, computer technology, chemical engineering and electronics.

Further information from the **Royal Norwegian Consulate General, 77 Pacific Highway, North Sydney NSW 2060. (02)92-6915.**

BRIEFS

RCA, after loosing more than $500 million on CED videodisc equipment, has decided to cease production, although it will continue to support it with software. Hitachi, which licenced the CED format for sale in Britain, is believed to have been disappointed by the RCA decision, since demand for its product has been growing at a healthy pace.

NEC has developed a planar indium avalanche diode for fibre optic applications. It has the potential to operate at 450 Megabits per second at 1-1.6 microns wavelength. Commercial production should begin next year.

NEC has developed an aluminium gallium arsenide semiconductor laser with basic lateral mode output of more than 50 mW and 80% optical conversion ratio.

Hitachi and Bridgestone have developed a prototype of a new robot arm that uses special rubber bearings to give it ultra-smooth operation. The macromolecular rubber used in the arm was specially developed by Bridgestone for the robot.

Olympus, the Japanese camera manufacturer, has begun marketing a fully automatic colour video camera, the VX 305. It features a 6x power zoom, an electronic viewfinder and can operate in light levels as low as 20 lux.

Over 2200 metres of optical fibre has been laid by Data Cable in the Melbourne and Metropolitan Board of Works head office. The installation makes the building the biggest single fibre optics site in Australia. The fibres will be used for interconnection between the Board's seven large computers.

The Institute of Diagnostic Engineers is holding its first annual convention in London between the 4th and 7th September, 1984. Further details are available from IDE, 3 Wycliffe St, Leicester LE1 5LR, England.

Ness Security Products has been awarded the Australian Design Award for Security Alarm control systems for its Necessity System 5+. The unit conforms to AS2201.

Tandy Corp has just released figures for its sales to April. Spokesman for Radio Shack, the parent company, called the $198 million sales figure "disappointing". The figure represents a one percent rise in sales from last year.

A NOTE ON THE ETI-733 RTTY DECODER

This popular decoder has found favour among amateur radio and computing enthusiasts alike. BUT — some constructors have reported difficulties. Two common problems have arisen. Instability in the decoder and the displaying of gibberish. Some kit suppliers erroneously supplied hi-K ceramic capacitors (bypass only) where greencaps were specified. Naughty! C1-4 are greencaps, along with C6. Only C7 can be a ceramic type. It is **imperative** that the VCO capacitor, C3, be a reasonably stable type — like a greencap, NPO ceramic, dipped mica or silver mica, polyester, etc.

The second problem relates to the software. The listed software was developed for Microbees running a 2 MHz clock. With the introduction of the IC model the clock was changed to 3.375 MHz. Running the original software throws all the baud rates out — hence the gibberish. You can fix it one of two ways — do it yourself, or get a 'universal' software tape from Tom Moffat.

To fix it yourself, load your software (under Monitor, not BASIC). Examine location 04AC. There you will see '0B'. Change it to '12'. Re-record the tape from Monitor. Now you have a 3.375 MHz version. (You do have a back-up of the original, don't you?).

The second method is to send Tom Moffat $12 and ask for the 'universal' RTTY decoder tape. It's so cunning, it works out what model Microbee you've got and adjusts the value of 04AC accordingly! Send your rustproof sheckels to: **Tom Moffat, 39 Pillinger Drive, Fern Tree Tas. 7101.**

For our readers: a fabulous chance to WIN

Sanyo Australia, in conjunction with Electronics Today, is offering a Betamovie camera pack outfit and a VTC-M10 video cassette recorder with cord remote control as a prize in this great contest.

Sanyo/ETI Betamovie Home Video Contest

All you have to do to enter the contest is answer these simple questions and tell us in 50 words or less, what you would like to do with the Sanyo Betamovie Home Video Outfit.

(1) What is unique about the Betamovie systems?

.....

.....

(2) Does the Beta video tape format use 'M-loading' or 'U-loading' to take the tape from the cassette?

.....

Now tell us in 50 words or less just what you would like to do with the Sanyo Betamovie Home Video outfit described here. (Betamovie camera pack and VTC-M10 recorder with cord remote.)

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Contest closes 1 October, 1984
SEND YOUR ENTRY TO:

Sanyo Electronics Today
Betamovie Home Video Contest
P.O. Box 227,
Waterloo, NSW 2017

• I have read the contest rules and agree to abide by their conditions:

Signature .....

A complete home video provides hours of enjoyment for families, for friends — in fact, for everyone. Especially when it's the brilliant Betamovie package from Sanyo! The outfit comprises the famous Betamovie camera plus accessories, AND the very popular VTC-M10 VCR. You could win the lot — simply by entering our great new contest.

DON'T DELAY — ENTER NOW!

You may enter as many times as you wish but you must use a separate entry form for each entry and include the month and page number cut from the bottom right hand portion of this page. You must put your name and address on the entry form and sign it where indicated.

Please read the contest rules carefully, especially if sending multiple entries.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Sanyo Australia, the Federal Publishing Company, Eastern Suburbs Newspapers, The Litho Centre and/or associated companies.

Closing date of the contest is 1 October, 1984. Entries received within seven days of that date will be accepted if postmarked prior to and including 1 October, 1984.

The winning entry will be drawn by the Managing Editor of ETI, whose decision is final. No correspondence will be entered into regarding the decision.

The winners will be notified by telegram the same day the result is declared. The name of the winner, together with the winning answers, will be published in the next possible issue of Electronics Today International.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry form the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you can send an original page number with each entry form.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration, accompanying the contest, that they have read the above rules and agree to abide by their conditions.

SANYO'S BETAMOVIE

Home video outfit

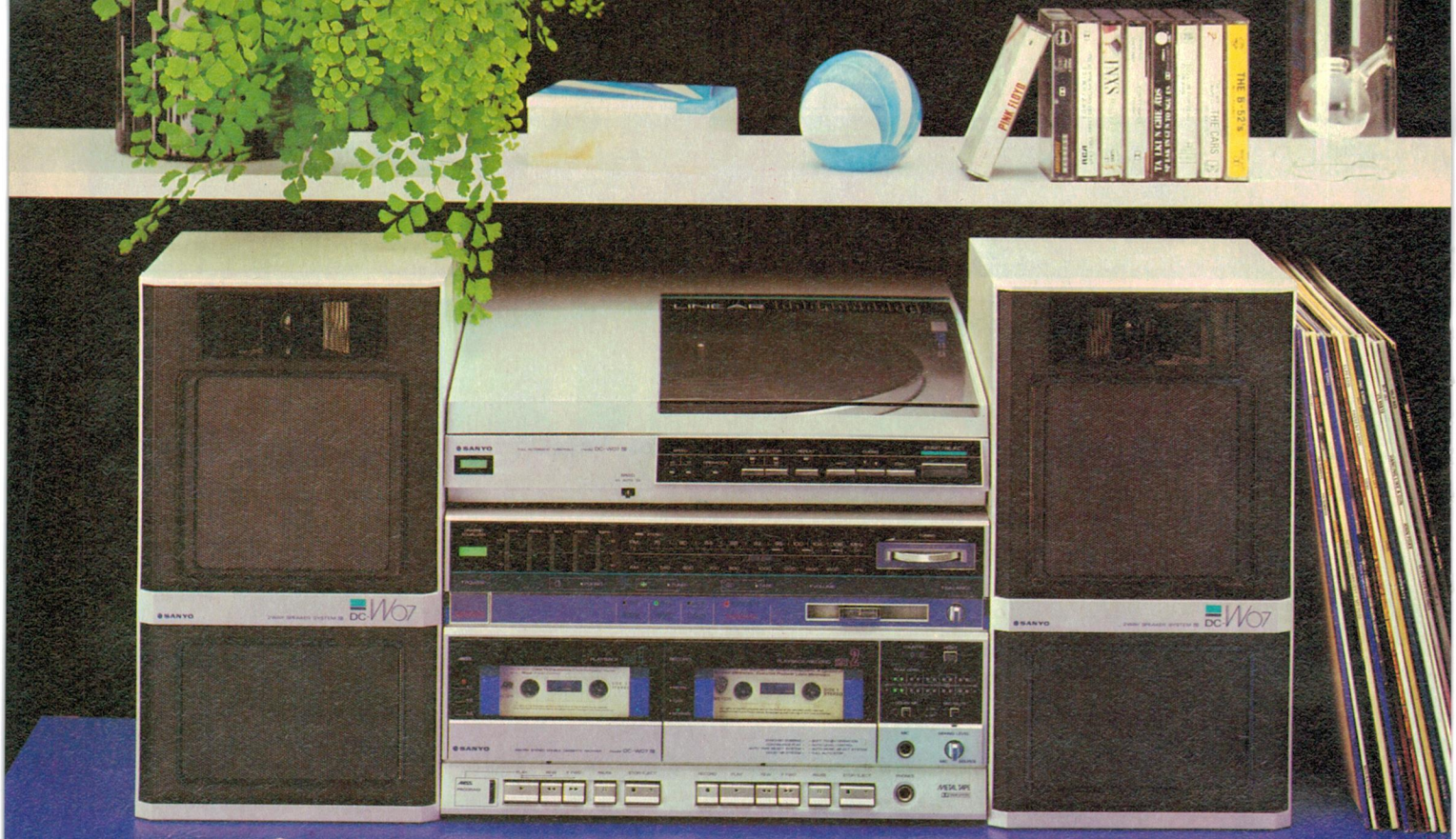
BETAMOVIE CAMERA PACK

This includes the famous Betamovie camera with an attractive carrying strap, rechargeable battery and ac adaptor/charger pack. The Betamovie camera is the only video camera currently available that will record on a standard video cassette (Beta) which can be transferred direct from your camera to your VCR for instant viewing immediately after shooting. This system is just perfect for family shots, holiday scenes, around the home, etc. The camera will take any standard Beta cassette and gives up to one hour's shooting with the battery pack. Worth $2386.

VCR WITH CORD REMOTE

One of Sanyo's most popular Beta video cassette recorders. The recorder features front loading, a 12-channel tuner and an 8-day/single programme timer for recording while you're not around. The controls include fast forward/reverse 'search' modes and a pause/still-frame button. The digital display features seven-segment fluorescent numerals for easy viewing in clock or programme mode. The display shows the time when not in the programme mode. To record a programme in your absence, simple set the start and stop times and enter them in the memory. Worth $637 (rrp).

Total Value: Over $3000



We've got a winning system.

Midi Component System with stereo Double cassette deck, AM/FM Stereo Receiver, Linear tracking turntable and 2-way, 2 speaker system from the Giants in Audio.

SYSTEM W07

Double-Cassette Deck

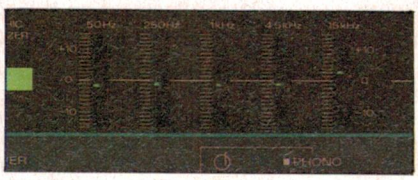
Double-cassette deck with continuous and synchronous dubbing. The music never stops when you're listening to tapes on the Sanyo W07. With the ingenious continuous play function, you simply place a cassette in each deck, press the play button for the tape you want to hear first and then the play button for the other deck. When the first tape has ended, the second one will begin automatically–slip a new tape into the first deck, preset the play button and you've started a cycle of music that can go on as long as you like. And it's just as easy to make copies of your tapes. With just one push of the auto play button, synchronous dubbing begins–and when the recording procedure is over, the unit switches itself off automatically.

Direct Call Function.

Take your pick of radio, tapes or records and then simply press the button for that source–instant operation with no fuss! With auto play activated, all you need to do is press the turntable start button for playing records, the AM or FM button for radio listening, or the play button on the deck for tapes.

5-band Graphic Equalizer.

The W07's amplifier section delivers a hearty 28 watts of power per channel to fill your room with lively sound brilliance. And to fine tune those sounds, Sanyo provides the tone control freedom of five separate sound adjustors that boost or cut selected frequencies by 10dB.



Synchronous Recording.

Once again, the auto play button makes life easier. For perfect recordings of records, just press auto play, place the record on the platter, prepare the deck for recording and start the turntable. The deck will begin recording as soon as the needle is in the groove.

Linear Tracking Turntable.

Your records will sound better than ever with the W07's highly accurate linear tracking system. And they're easier to play, too. With the Auto Speed Selector, the turntable determines the correct record speed from the size of the record. When Sanyo says "fully automatic," they really mean it!

Flat Speaker System.

There's yet another delightful surprise awaiting you in the W07–rectangular, flat woofers! Flat, so the sound reaches you with full brilliance. And with the 5cm cone tweeters, sound is reproduced with the realistic balance only a 2-way system can offer. The passive radiator is also flat, and helps deliver powerful bass for a truly vivid musical experience. You can't lose when you're on the winning system–but that's life.

SANYO

That's Life!

The Consumer Electronics Show, August 1-5, in Perth could become a turning point for almost every sector of the consumer electronics industry in this country. Compact disc has been a major success but laservision has failed to take off, the home computer is suffering from savage price competition, but the car sound market seems set for a boom. What might be waiting in the wings?

WHICH WAY NOW?

The Industry asks the Marketplace

Jon Fairall &
Roger Harrison

Hi-fi video. Hitachi's VT-88E VHS video recorder features a dynamic range of 80 dB, full-range frequency response of 20 Hz to 20 kHz and extended 8-hour recording/playback with E-240 tape. It's also got a stereo tuner.

THE MANY 'strands' of the consumer electronics industry can be likened to an octopus — lots of long tentacles reaching out from a central body. There are times when the tentacles, moving independently, move the central body forward, but it seems there are also other times when all the tentacles are frantically active, but no progress is made.

It seems that that's where the Australian consumer electronics industry is at right now.

Reverse in a fifth of a second! Aiwa's AD-R550 auto-reverse cassette deck features an ultra-quick reverse time of 0.2 second! In addition it has Dolby B-C noise reduction and an "edit-assist" function amongst its sophisticated controls. ▶

CDP-101

COMPACT disc DIGITAL AUDIO

Hear digital perfection.

Introducing the Sony Compact Disc Player.

When we used our long experience in digital technology to create the CDP-101 Compact Disc Player, we wanted to give you something more than the world's clearest sound.

WIRELESS REMOTE CONTROL Full-function remote control.

3-WAY MUSIC SEARCH ☐ Instant direct access to any selection with the 10-key pad on remote control unit. ☐ AMS (Automatic Music Sensor) allows access to the beginning of next or previous selection. ☐ 2-speed bi-directional search to find any desired music passage.

REPEAT FUNCTION Program to repeat the entire disc, one selection, or a specific portion of music.

3-FUNCTION DIGITAL READOUT DISPLAY ☐ Selection number. ☐ Time lapse of selection being displayed. ☐ Remaining time on the disc.

LINEAR SKATE DISC LOADING Just press the button, platter control and cueing are automatic.

Get even more perfect sound with the Sony Digital Audio Component System, "Precise Series".

It's a Sony

SONY®

AUD 0391

CD — booster for hi-fi

The hi-fi arm received a good 'booster' shot from the injection of the compact disc last year. Most importers of CD players report they can't get enough stocks — almost irregardless of the price bracket of the machines. Funny thing though, it has also given a boost to turntable sales! Buyers who see and appreciate the advantages of the CD player, but for a variety of reasons don't want to get one right now, upgrade their turntable. Coincidentally, there has been a boost in cartridge sales.

For those who've joined the rush to CD, it seems they then find deficiencies elsewhere in their systems and some are coming back to upgrade amplifiers and speaker systems. The occasional customer does it all at once!

The introduction of CD has made the designers and manufacturers of other equipment in the hi-fi stable re-examine their products. As a result, amplifier specifications have been pushed to yet new heights as has the performance and features of things like cassette decks. Prices are dropping, too. Amplifiers with unprecedentedly low hum, noise and distortion figures will become commonplace in the next year. They'll have to, just to match the performance of CD players.

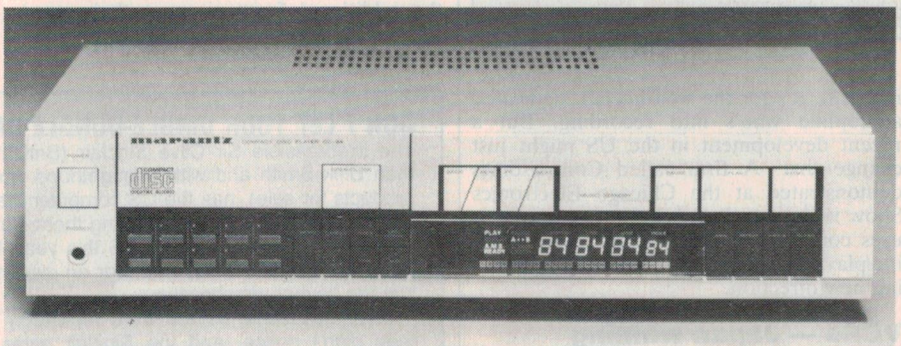
Yamaha's new range of control preamps and power amps — C40/M40, C60/M60 and C80/M80, are a case in point. They boast vanishingly low distortion, hum and noise figures well below that achieved by many previous systems and the peak output levels necessary to cope with the compact disc. Actually, Pioneer was one of the companies to lead the way in new amplifier technology, with their A-8 amplifier (and lower-powered siblings) featuring 'nested feedback loop' distortion-reducing circuitry. In years gone by, you'd pay six months salary for the sort of performance now offered.

The way ahead here is fairly clear — features and performance will go up, but prices will come down. But how far is it *really necessary* to go before the real benefits stop and the sales gimmicks begin? At an engineering conference last year, Professor Edward Cherry of Melbourne's Monash University ably demonstrated that it is impossible for listeners to distinguish between systems with markedly different distortion levels once the distortion is down to thousandths of a per cent.

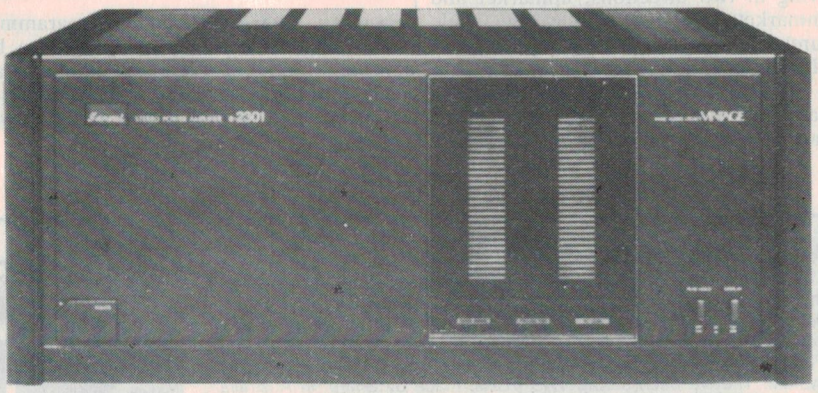
Some manufacturers now offer specialised 'equaliser' controls on their amps — designed to compensate for the deficiencies of your listening room. These are not new, by any means, but were previously offered mainly as a separate component. It remains to be seen whether equaliser controls will become an issue with the hi-fi buyer.

Cassette decks have improved markedly in performance over the last year or two and in addition, now offer 'music search' and control features rivalling those on the most sophisticated (and expensive) compact disc players. Here too, prices are coming down while performance and features are going up (see the ETI reviews of Nakamichi's RX-202 auto-reverse cassette deck, April '84 issue, and the Aiwa F990, July '84).

CD for the car? Next move for CD players is to put them in the car. But vibration presents a technical problem with mistracking. Sony have solved that, they say. This is their CDX-5 in-car CD player, released at the US Chicago Electronics Show in June. Who knows when we'll see it here.



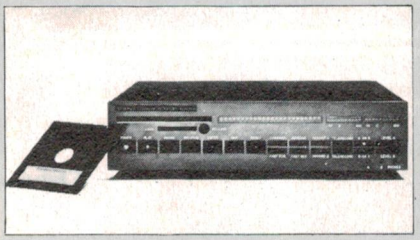
August release. Marantz is releasing their CD-84 compact disc player this month. It features an infrared remote control 'commander' and a 24-track programming facility. Expected retail price is $899.



Amps for the digital age. Sansui's new crop of amps feature 'X-balanced' circuitry to obviate problems with ground-related distortion. The amp circuitry is balanced from input right through to output. The B-2301 here delivers 300 W/ch. at 0.003% THD and has a signal-to-noise ratio of 120 dB, Sansui claim.

It's quite clear that CD will have little effect on cassette deck sales. Until, that is, someone releases the play-and-record compact disc. And that might be closer than you think.

Digital recording (known also as 'PCM' — for 'pulse code modulation') for the domestic market is still in its infancy. At the ▶



Something *really* new. There are very few record/replay digital audio machines on the market at present. This machine might represent the 'face of things to come'. It is a low cost digital PCM recorder that uses 5¼" computer floppy disks on which to record/playback. Thus it has the advantage over compact disc, but it can only accommodate about 20 minutes per side. Compusonic of the US released it at the June Chicago Electronics Show this year. Who knows where it will lead?

moment, it's for the well-heeled, dedicated audiophile who's into recording. But a recent development in the US might just change that. A firm called Compusonics demonstrated at the Chicago Electronics Show in June a digital audio recorder that uses computer floppy discs as the recording/playback medium. Could be an interesting new direction.

VCRs — Japan winning

Video cassette recorders are alive and well in the market place. Model-wise, the manufacturers are going the traditional way — evolving in two directions, upmarket and downmarket. Prices are edging down while features are being retained or enhanced in the lower end of the market. At the top end, sophisticated features and functions are appearing at regular intervals. Stereo sound, however, was only cautiously released by a few manufacturers, probably owing to the impending introduction of stereo/dual-channel sound for TV stations. Hi-fi video has also been cautiously released, but now that the stereo question has been more or less settled, we'll see a rash of models with 'hi-fi' stereo sound. But laserdisc is hanging pregnantly round the wings.

Meanwhile, a few firms are offering add-on units that dramatically improve the sound on older model VCRs as well as providing pseudo-stereo.

Manufacturers estimate there are about 50 million consumer VCRs in use in the world. They predict the product will be popular for several years yet. About 95% of all machines are made in Japan. Philips VHS VCRs sold here are made by Sharp.

Heavy promotion and aggressive marketing are given as the keys to the success of the Japanese. They first develop the basic product carefully and take an evolutionary approach to improvements. Thus, consumers are encouraged to buy new models as the additional features meet their needs (like infrared remote controls, hi-fi sound, 28-day multi-programme programming etc). The consumer is not forced to buy through rapid obsolesence. Philips made this mistake with their V2000 system in Europe, and paid for it (see accompanying panel).

Laserdisc — when?

We have seen some five releases of laservision here in as many years. And it's still waiting in the wings. Pioneer's history of attempting to launch the product here reads something like a mirror-image of Nellie Melba's farewells! Full marks for trying, though.

The confusion over standards in videodisc, the high introductory price compared to competing products (which would include swimming pools) and the sophistication of the technology has probably held the consumer at bay. As the sophistication of other consumer electronics products grows and grows, it shouldn't be too long before it approaches laserdisc, at which stage public acceptance should rise to meet it. The compact disc, the latest crop of VCRs and the home computer, all well-accepted items now, should contribute to the acceptance of videodisc. But just when that's going to happen is the $64 million question.

The play-only facility of laserdisc is seen as a possible drawback, but it's been no barrier to CD. The market relationship between audio cassette recorders and record/CD players should be mirrored in the video market between VCRs and videodisc. But the question is, will it? And if so, when?

DON'T LET YOUR DINGLE-DONGLE DANGLE IN THE DIRT

The irrepressible Sir Clive Sinclair (British consumer electronics whizz more famous than Dick Smith and with a knighthood who has actually designed and manufactured products for sale), has the US computer market on a string.

Or maybe it's that he's stringing them along.

At the Chicago Summer CES this year, he showed off his QL (for 'Quantum Leap') home computer. He had just four on display, securely locked under plastic covers with just the keyboards showing.

Interested trade buyers were reportedly impressed by price and performance. But they didn't notice, and the Sinclair sales staff were omitting to mention, the little dingle-dongle hanging on a wire string out the back of the machine. Packed in there was the ROM Sinclair's engineers couldn't fit inside the case. Tsk, tsk.

AH SO. HONOURABLE FOE

The Dutch electronics giant, Philips, has admitted defeat and bowed to the rising Sun. Having invented the world's first domestic VCR over a decade ago, Philips has had to bow to the might of Japanese technology and marketing. It is now selling Japanese-made (from National Panasonic) VCRs in Europe in direct competition with its failing V2000 system. They've been selling VHS VCRs, made by Sharp, in Australia for almost the past two years.

When Philips launched its V2000 domestic VCR system in Europe in 1979, it had damn near 100% of the market. The Japanese "video home service" (hence, VHS) came in late two years after them and rapidly stole 70% of the market (Beta came later still and only got a minor share there).

Philips' V2000 market share dropped to around 2% by last year so they went to Matsushita (National Panasonics' parent) last December and got a quarter million VHS machines to sell in Britain as a stop-gap.

Philips' factories in Austria and West Germany are currently assembling Matsushita VCR kits prior to tooling up to make their own components.

The picture here is from a British advertising billboard!

Home computers — a shakeout?

The home computer market is going through a bust overseas. The giant Warner Brothers' Atari home computer division has hit hard times and laid off over a thousand workers and pulled in the reigns heavily over the past nine months. Texas Instruments' TI-99/4, dubbed the 'Ti-tanic' by some sections of the industry, is no more and TI has had to close plants down. Tandy's TRS-80 MC-10 Color Computer lasted less than six months in the market place before they had to start 'sale-ing' it out at around a quarter its introductory price. Commodore's VIC-20 will be discontinued but had a dream run of around *five years*. The C64, popularly voted the best home computer in a magazine reader survey conducted in the US and Europe earlier this year, dominates the marketplace and certainly has the most prolific support from 'outside' software and hardware add-on producers.

The signs of what happened in the CB market shakeout a few years back — savage price competition, followed by rapid model run-out, then steeply falling sales — are all there in the bottom end of the home computer market at the moment.

The industry has a buffer, however. The bottom end of the home computer market is

Into the serious stuff. Atari's push into 'serious' computing in that no-man's land between the bottom-end 'toys' and the upmarket business machines is their 800XL. It features 64K of memory, thousands of programs available and the disk system option runs the popular CP/M operating system. It's also a NSW Education Dept. preferred computer.

HOME COMPUTERS: SHAKEOUT OVER?

According to Atari's Australian distributor, Futuretronics, the company has lifted its March sales figures for home computers to more than double its December '83 sales.

Atari's US market share in December was reported as 11.6%, but it rose to 23.2% in March. Futuretronics says that Atari and Commodore now account for almost 70% of the under-$1000 US home computer market between them. So it looks like the shakeout is over.

The closeout of opposition manufacturers, allowing a degree of stability to return to the market, is the reason for Atari's lift, according to Futuretronics' Managing Director, Peter Alpar.

"BREATHE INTO THE BAG, SIR"

Controversial US hi-fi equipment designer, Bob Carver, has pulled another of his now-famous shrinking tricks.

He first shrunk the monstrous hi-fi power amplifier to the volume of a couple of house bricks with his M-400 'cube'. This product used his power-switching 'magnetic amplifier' technique that delivers power output only when the input signal demands it. In this way he eliminated the huge heatsinks and heavy transformers necessary in conventional hi-fi power amp designs. The M-400 delivered 200 watts per channel.

At the Chicago Summer CES in the States this year, he produced a *beer-can sized* stereo amp that delivers 200 watts per channel! Carver says he did it to prove that the technology exists.

Dubbed the 'Cubelet', he will not be selling it because he says it will cost at least US$1000 and be a throw-away item if anything went wrong. The components are nested together inside a metal case and potted with resin. Apart from that, here, the law wouldn't believe it.

"But officer, I didn't have the volume wound up past 2!"

Get behind the wheel. Video games are alive and well, led by CBS-Colecovision. The popular Colecovision games unit can be turned into a racing car cockpit with this add-on "Turbo" module.

The game's graphics really puts you behind the wheel at Indianapolis.

IT'S BEEN WORTH WAITING FOR.

Pioneer's extraordinary second generation Compact Disc Player is here.

Time flies. Only 18 months ago, the hi-fi world was stunned by Pioneer's Compact Audio Disc player. Its laser and digital technologies introduced near-perfect stereo sound reproduction. "How will they top that?", they asked.

With the extraordinary new PD-70, Pioneer's second generation Compact Disc player.

We started by making the compact disc player more compact. The PD-70 loads horizontally (not to mention automatically), making system mounting much more practical.

The PD-70 is also an incredibly stable compact disc player. Comprehensive internal damping and robust construction means the PD-70 won't "skate" during operation.

The PD-70 is more intelligent too. Its memory can be programmed to repeat tracks up to 10 times and that programme can be interrupted or amended at any time.

The PD-70's 16-"bit" Digital Binary Display is the most sensitive and versatile metering system yet devised. It breaks signal values down into 6dB increments - and switches to a "peak metering" mode at the touch of a button.

And, because all of the displayed information is both sourced and expressed digitally, the PD-70 can claim to have the most accurate metering display system available.

The PD-70's specifications speak for themselves: Dynamic range has been improved to 95dB. Signal-to-noise ratio has been improved to 95dB. T.H.D. is down to 0.004%, 1kHz.

Compact Disc has taken the next step. Pioneer's new PD-70 gives you music that is virtually distortion free, and laser technology means that your music need never deteriorate.

Pioneer's PD-70 means simply better stereo sound; a step closer to musical perfection.

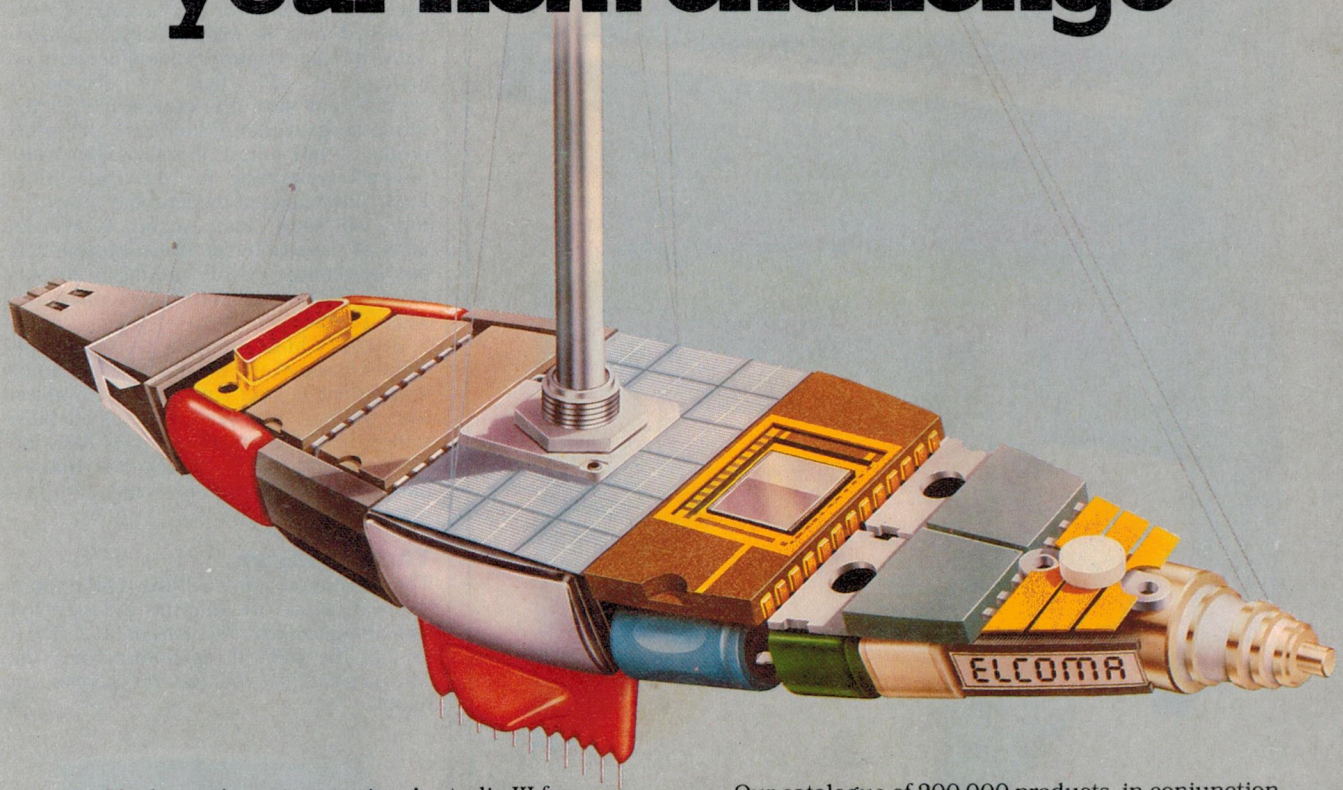
In our opinion, that's always worth waiting for.

PIONEER®

Leads the world in Sound and Vision.

PIO 0369 B

Smart electronic components for your next challenge



Maybe you're not preparing Australia III for the next cup challenge, but if you're an Australian manufacturer you are well aware of the international competition that you face. Their strategy and techniques to drive you out of the race will be very crafty indeed.

Perhaps you're wondering, "What could electronics really do for my product?" Up to this point, you've got by very nicely with conventional solutions. But just for a moment, think about the benefits you could offer your customers. If you build a unique product that has intelligence and is better suited to your market requirements, your product could stand head and shoulders above the rest.

Now, if you have considered electronic solutions before, but your production manager and technical advisors have said it's just not feasible to pay for the development of specialist electronics, then things have changed.

Our catalogue of 200,000 products, in conjunction with our local design laboratories, offer options and solutions to Australian manufacturers. We offer "hybrid technology" using discreet chip components with, standard or custom designed, integrated circuits. A specialist design group and factory right here in Australia can quickly give you a unique customised electronics package. Something very difficult for your competitors to copy.

Take the lead. Don't wait for your competitors to make a dash for the line, because you can win the tactical battle and carry off the prize.

Philips Elcoma are keen to join your crew.

Phone us in:

Sydney	**427 0888**	Melbourne	**542 3333**
Adelaide	**243 0155**	Perth	**277 4299**
Brisbane	**44 0191**		

We make electronics in Australia

PHILIPS

Electronic Components & Materials

PHILIPS

TAW P001-253

A keyboad genius. Lowrey's Model G100 'Genius' electronic keyboard instrument is claimed to be the forerunner of a completely new generation of electronic musical instruments. It offers ten voices, from piano to synthesiser, plus cartridge software to give you differing style or rhythm formats. A 20 W amp is built-in.

really chock full of 'toys'. Once the boom 'trendy/curiosity' phase is over, and it seems imminent, then the 'useful' computers will find their place as virtual 'tools' in the home. Consumer spending will move up-market once again. That's already started to happen, in fact. Those machines in the 'no-man's land' between the $99-$299 toys and the $2000+ business machines are enjoying strengthening sales at present. They're no toys and it's the 'educated/aware' consumer buying them for self-education, wordprocessing etc. Many are second-time buyers upgrading from a toy they've dabbled with over the past year or two.

The industry is only just beginning to tap the vast education market and this will be another chink in its armour against the shakeout at the bottom end.

What else?

The next product area slated to make big inroads in the home electronics scene is — electronic musical instruments; keyboard instruments in particular. Electric/electronic home organs and pianos have been around for yonks. But they have traditionally been big-buck items, the purchase decision always riding behind the second car/dishwasher/pool etc.

Digital electronics, advances in technology and mass production have dropped the prices and dramatically upped the features while allowing the development of a broad product range. It's the same old story that's happened with every other sector of the consumer electronics market.

The 'toys' appeared about 18 months ago, pioneered by Casio (the calculator people) and Yamaha. Roland, big in the pro music scene, has produced both an electronic piano and a synthesiser under the 'magic' $500 price point, for example.

Car sound, too, is getting ever more sophisticated while the prices are moving both up and down market. Car CD players, fondly test-marketed by Philips, National, Mitsubishi et al, will likely make a real appearance in the next twelve months.

Meanwhile, top-of-the-range car radio/cassette players get evermore features and better in performance. Pity the cars don't.

Stereo/dual-sound for television looks likely to give 'the box' a long-deserved shot in the arm. (See article elsewhere in this issue). At present, the cost of stereo TV sets launched onto the market is high. But, initially at least, importers/manufacturers are looking to sell them as 'second or replacement' sets. The current models featuring stereo with hi-fi sound are all top-line products, with a host of other sophisticated features accounting for the high prices. Later, lower-priced models with fewer features will sport stereo sound. Conversion units are available for some existing sets, but are relatively costly and this is not seen as a significant market (or maybe they don't want it to be!).

Personal hi-fi products — Walkmans, 'ghetto blasters' and the like — have rapidly found their market since being introduced over the past two years and it's all fallen rather flat. No significant new developments are on the horizon so it seems this line of products is ripe for innovation. But what?

The question

The question is now, will the market point the way ahead or will the industry find something to excite the market? It seems to us that the ball's in anybody's court. He who serves first will win the service, no doubt. ●

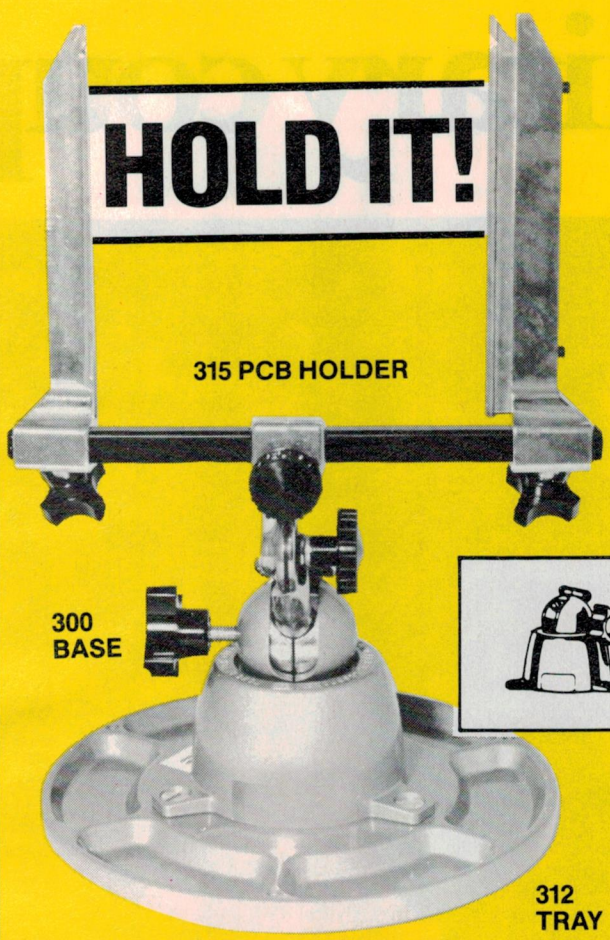
Digital-age speakers. The Danish-designed Jamo speakers feature a unique bass-reflex design with the port venting around the woofer rim. The model 1702 is shown here.

Anywhere you want it...

HOLD IT!

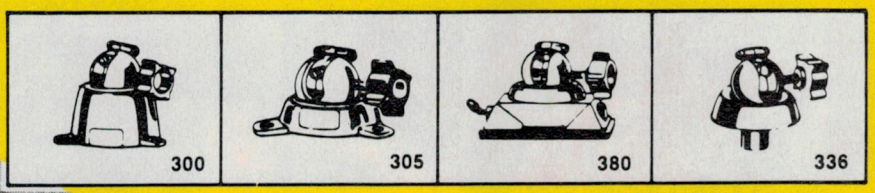
SCOPE PANAVISE

Work holding system with Interchangeable heads and bases.



1 TAKE A BASE

NOTE 300 & 305 CAN BE SCREWED DIRECT TO BENCH



380 VACUUM BASE

Moving the black-tipped lever arm attaches the Vacuum Base instantly with a firm grip, without marring, to smooth non-porous surfaces.

336 UP/DOWN CONVERTER BASE

An attachment for the 325 Up/Down Positioner giving the additional dimension of variable height (14" or 355mm).

300 STANDARD BASE

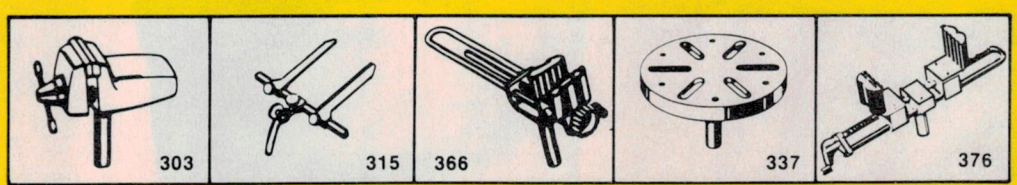
Holds all regular PANAVISE heads and Circuit Board Holders. The patented load control knob and exclusive split-ball feature have a range of tension which permits moving of work to any position desired.

305 LOW PROFILE BASE

The Low Profile Base has all the tilts, turns and load control features as in the Standard PANAVISE base. Only 2½" (64mm) high.

2 ADD A HEAD

5 INTERCHANGEABLE HEADS tilt, turn and rotate, then lock in any position.



303 STANDARD HEAD

The top selling head, it has jaws 2½" (63.5mm) wide which open 2¼" (57.2mm). The tough yet gentle nylon jaws have a satin finish to improve grip.

315 CIRCUIT BOARD HOLDER

(Extra Arms Available)
Holds p.m. boards any shape and size to 12" (304mm) wide (including the S100) exactly where you want them – flat, vertically, or any angle in between, when used in a PANAVISE base.

366 WIDE OPENING HEAD

Opens a full 6" (152mm) with jaw width of 1¾" (44.5mm). The contoured neoprene jaws provide a cushion over the steel jaw plates to gently yet firmly hold delicate items.

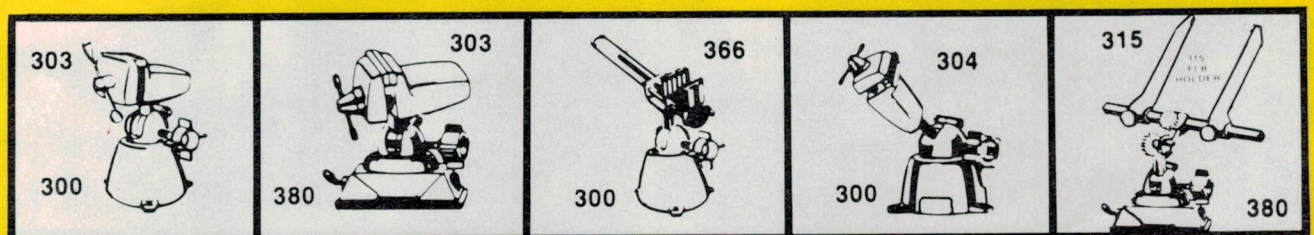
337 FIXTURING HEAD

Permanent fixturing for production line assembly or repetitive repair work can be designed and bolted to this head easily with its six slots and bolt holes. The flat ground surface is 5⅜" (137mm) in diameter.

376 SELF-CENTERING HEAD

(Extra Wide Operating Head)
Double Action Jaws. Allows fast opening and closing.
Large Capacity – Opens to a full 9"
Reversible Jaw Pads – Flat one side
Fits all PANAVISE series 300 bases.

HERE ARE SOME TYPICAL COMBINATIONS



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The military coup

# of Lieutenant Wilson. Aged 20.

When you talk to Geoff Wilson about his 18 months in the Army you can't help but feel he's a young man who's come a long way in a short time.

Already he's graduated from Officer Cadet School, Portsea, with a commission as a Lieutenant. And already he commands an Infantry Platoon of thirty men.

It's a tremendous responsibility. Especially for a 20 year old. But as Geoff says, "You get enormous satisfaction from using what you've learnt in your training to help bring out the best in your team. And in achieving results together."

"Obviously situations which I haven't had experience in crop up all the time. And that's when I have a real responsibility to myself and my men to make decisions based on sound knowledge rather than guesswork. As a result you constantly find yourself learning and mastering new skills. And that's a challenge I always enjoy accepting. You really begin to realise your full potential and believe in your ability."

"I suppose you might say my decision to take on a career as an Army Officer is my personal 'military coup'."

"It's hard to visualise another career as exhilarating, varied and satisfying. Or which provides as many opportunities to be recognised and rewarding for a job well done."

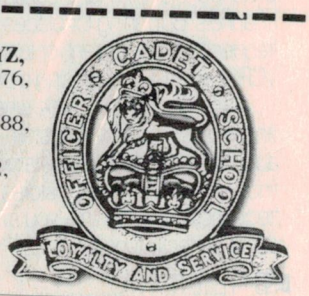
"Think about it carefully. I know I did before joining!"

Armour, Artillery, Engineering, Survey, Signals, Transport, Infantry, Intelligence and Aviation are just some of the fields open for you to enter.

If you're aged between 18½ and 23 on the first day of the month in which the course commences (or up to 25 with a degree or diploma), have your HSC or equivalent, (at a level acceptable to the Army), and think you have what it takes to pull-off your own military coup, contact your nearest Army Careers Recruiting Centre or fill in the supplied coupon.

There are two courses per year. Applications close mid-March for a July entry and early August for a January entry.

For more information post coupon to GPO Box XYZ, in your Capital city. Sydney 2195555, Newcastle 25476, Wollongong 286492, Albury 552248, Lismore 216111, Canberra 822333, Melbourne 6979755, Geelong 21 1588, Bendigo 438008, Ballarat 31 1240, Brisbane 2262626, Townsville 724566, Adelaide 2121455, Perth 3256222, Hobart 347077, Launceston 31 1005.



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Imagine a stereo television with more features than MGM.

The last bastion of mono sound has fallen.

Stereo has come to television with stereo films, stereo concerts, stereo sports broadcasts. Even the weather will soon be in stereo.

Just one thing before you buy your stereo TV. Don't only listen to the sound; look at the picture.

Philips and only Philips have the famous Natural Colour picture to match the Natural Stereo sound.

Stereo is just the tip of the iceberg. Each Philips stereo set is a treasure trove of new features, accompanied by a dictionary full of new terms.

☞ SPATIAL STEREO.

While the kids are hogging the front of the screen you can sit to one side and still hear perfect stereo.

The Philips amplification system electronically enlarges the stereo effect spreading the sound throughout the room.

☞ ENHANCED SPATIAL MONO.

The stereo you have when you're not having stereo. Of course at first many TV programmes will still be in mono.

But this Philips invention separates the sound signal by frequency into two groups and pumps each group to a separate speaker. Dramatic sound, even in mono.

☞ VST.

It doesn't stand for Very Simple Tuning, but it could.

Every Philips Stereo Television is pretuned to all mainland capital city channels. But tuning for places where frequencies are different, or to tune a VCR is as easy as pressing a button.

No more twiddling little wheels and knobs. This Philips system automatically searches the airwaves, finds a channel and then stores the frequency. So every time you switch on it's perfectly tuned.

☞ TELETEXT.

Teletext is like a push-button newspaper. With Teletext you can receive pages of constantly updated information. And for the hearing impaired, Supertext Subtitles on programmes can be received.

Teletext today (buy it already fitted), or tomorrow (an optional kit can be fitted when you're ready).

☞ FRINGE SWITCH.

Out of town no longer means out of tune.

For people living in fringe areas which only get weak signals, a switch dramatically improves the reception by boosting the power of the signal once it's received.

☞ BILINGUAL SWITCH.

Here's a feature for the future. Already channels are gearing up for dual language broadcasts.

When two languages are being broadcast, you'll be able to switch from what you'd normally hear to hearing the other language.

☞ RGB.

An invention which cleans up TV graphics making them crystal clear and razor sharp.

Because now add-ons like video games, computers and Teletext avoid all the broadcast circuitry and plug straight into the high resolution picture tube.

☞ EXTRA PLUGS.

Plugs that mean that your Philips Stereo TV will always be the state of the art.

Use the Scart plug to connect either a VCR, videodisc, computer or hi-fi system to your TV. It is also vital for direct satellite broadcast reception.

A DIN plug means that with one connection you can play TV sound through your hi-fi system.

A headphone socket means that you can listen at a higher volume or to a different language, without disturbing the rest of the family.

And yet another plug allows you to connect extension speakers, for even greater stereo sound separation.

☞ REMOTE CONTROL.

The whole shooting match is controllable from the most sophisticated remote control ever created.

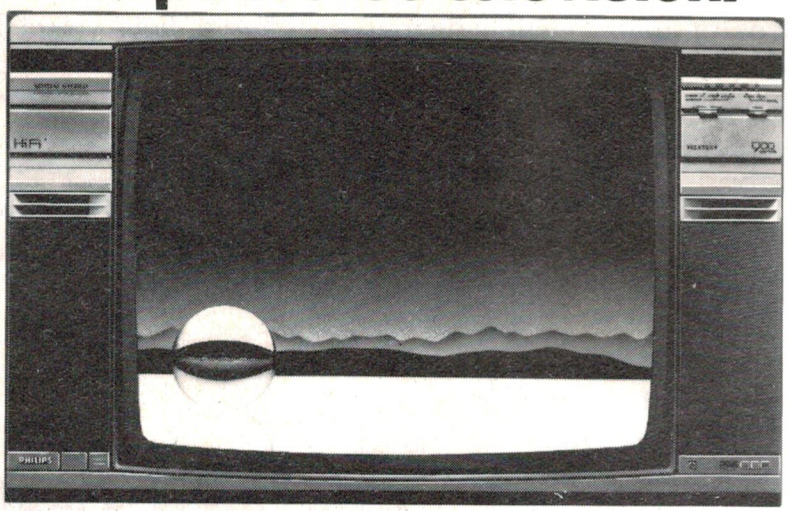
Everything from Teletext to bilingual selector to left-right stereo balance is incorporated into this one little box of tricks.

THE BIG DECISION.

When you come to buy your stereo TV do three things. First use your ears; can you hear Natural Sound? Then use your eyes; can you see Natural Colour? Finally use your head; does it have the features for today and tomorrow?

Only Philips has all three.

Philips stereo television.



PHILIPS We want you to have the best

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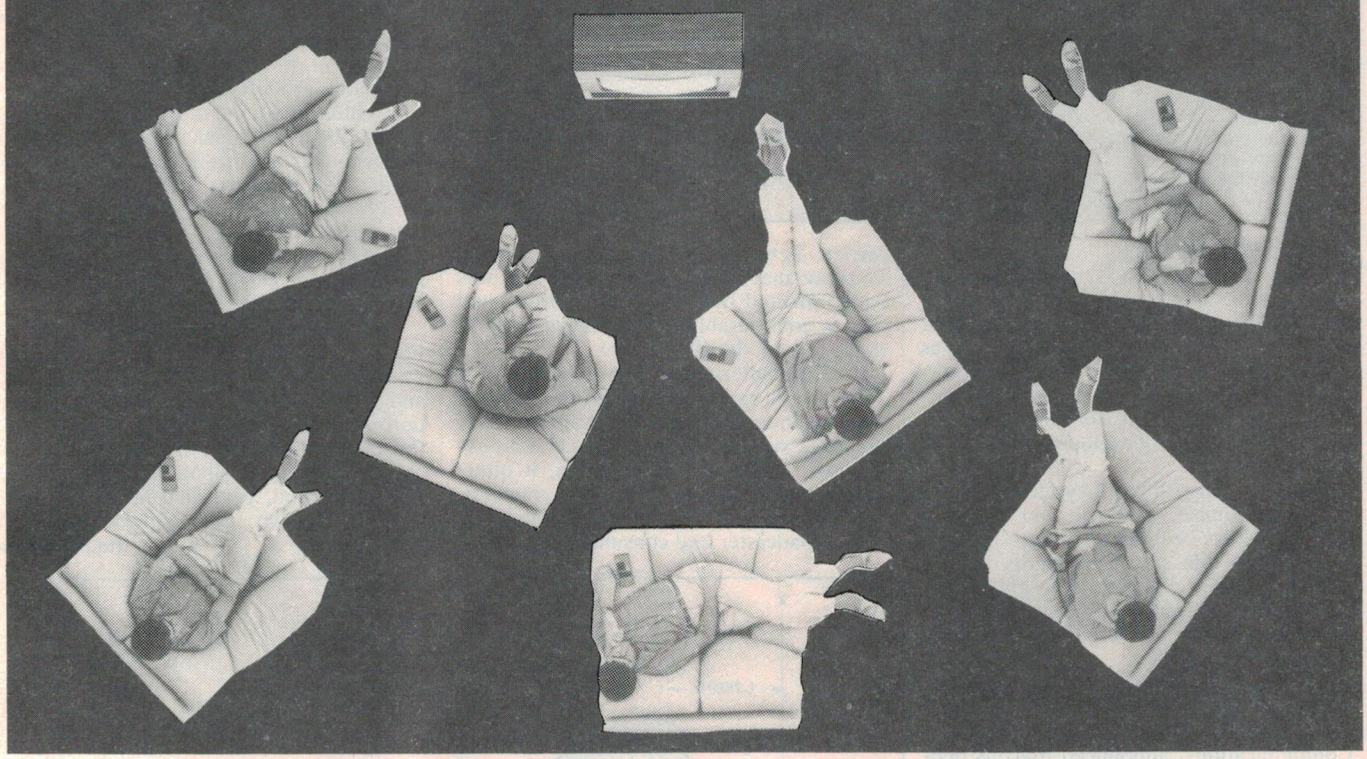
PMPV176

STEREO TV

Good sound cometh Says the minister



Jon Fairall

SOUND HAS ALWAYS been the poor cousin of TV. Conceived in a lo-fi world, the receiver industry has matured with tacky little speakers and more of a sound disaster than a sound system.

But times, as Dylan said, are a-changing. Hi-fi stereo sound is now available on all but the cheapest music systems in Australia. Whether the music is pre-recorded or broadcast, we expect it to sound good. Even lowly AM radio is trying to improve its image with a new generation of wideband receivers on the market, and the promise of stereo waiting in the wings.

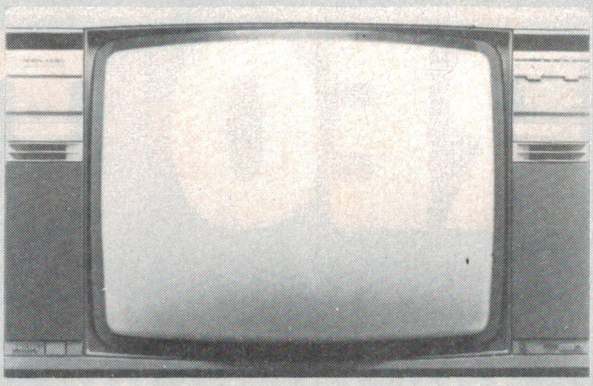
The sluggard in all this has been TV. In spite of a wideband FM sound signal TV audio still manages to sound as if it was recorded in a bathroom. One move to overcome the problem has been to link the programme sound with a stereo FM radio transmitter in a so-called *simulcast*. Such an approach works well, but it is expensive, both in financial terms and in terms of spectrum usage.

A far more sensible approach is to record and transmit the original programme material in stereo and try to pursuade TV receiver makers to pay some attention to audio design.

Recently there have been signs that these moves are all taking place. A number of TV sets have appeared in recent times with good quality speakers mounted in well-designed enclosures; albeit small, but it is a start. And at long last, stereo TV is a reality. ▶

But not on the ABC

THE SOUND THAT SURROUNDS



The Philips KR 863 Stereo TV. This model is typical of the new generation of television set that has been released within the last year or so. As well as exceptional video qualities which result in a fine resolution, high brightness picture, it also offers tremendous audio potential.

In the standard mode it has twin outputs capable of delivering 10 W RMS into 8 ohms. However, there is provision for sending the audio to an external amplifier, and thus the integration of the TV into a hi-fi unit, where it would form part of a total entertainment centre.

The idea of the entertainment centre is that all the typical domestic electronic components should be compatible with each other, so that the TV, VCR, record player, and cassette deck can all be played through one amplifier and one set of speakers. To get around the limitations imposed by the programme material, the KR 863 has the ability to synthesise stereo when receiving mono transmissions.

We'll be reviewing this TV set in next month's issue — don't miss it!

In the beginning

The first experimental transmissions were made, predictably enough, by the Japanese national brodcaster NHK, in 1978. Other countries have been playing with the idea as well. In 1981 the West German broadcaster, IRT of Munich, began transmissions using a system totally different from the Japanese. The BBC have also developed a system of their own.

With so many different systems competing on technical, political and financial grounds, it has been impossible to develop an industry-wide set of standards for the implementation of stereo TV sound. The big standards committees like CCIR and the EBU seem content to sit on the fence until the dust settles a bit.

In Australia, a decision has been made to adopt the German system. In December 1983 Michael Duffy, the Minister for Communications, announced that his department was prepared to undertake the licencing of two-channel sound transmission that conformed to the standards laid down by the Germans. They seem, on the basis of present knowledge, to offer the best performance characteristics of the competing systems.

The choice that had to be made was between the Japanese and German systems. The BBC system, called *sound on syncs*, was probably the most technically sophisticated, and probably offered the greatest potential for development, but it was ruled out of court as being too difficult to implement.

The Japanese system is called *FM/FM multiplex*. Essentially, it involves a double system of modulation in which the original carrier is modulated by a second sub-carrier. Tests carried out overseas seemed to show that the second sub-carrier was badly affected by multipath distortion and had a considerably worse signal-to-noise ratio. (About 10 dB, in fact).

The third alternative, the one selected for Australia, is called the *dual carrier method*. It seems to have significant advantages over the other systems. Proponents say it is easy to graft onto an existing system, it offers identical performance on both channels, and most important of all, it is cheap for both broadcaster and consumer.

The dual carrier system

To understand how the system works, consider the construction of a typical TV channel in Australia. The channels are 7 MHz wide, situated in 'bands' in the VHF and UHF regions of the spectrum. Within the channel, all the components have the same relative positions so that we can express the frequency of the various components with respect to the bottom edge of the channel.

On this basis, the most important element in the channel, the vision carrier, is situated at 1.25 MHz above the 'bottom' channel edge. It is amplitude modulated by the luminance information, the sync pulses and a number of other carriers. All this requires 5 MHz of sideband, so if nothing further were done we would need a 10 MHz wide channel to accommode both the upper and lower sidebands. However, there is no need to transmit one sideband, since the same information is contained in both of them. This is the rationale behind single sideband radio.

However, the single sideband approach is not viable in television, since it involves a sharp filter to attenuate one sideband while leaving the other intact. Unfortunately, it is impossible to design a filter without creating some phase distortion in the roll-off region. This is not a problem in radio, where the low frequencies carry very little information. But in TV it is disasterous, since the low frequency video signal is where most of the picture information is transmitted.

The answer is to compromise between the two systems. The lower sideband is attenuated by a filter, but not too sharply, and not at a rate that induces phase distortion into the upper sideband. In practise, this means that all the upper sideband, the picture carrier, and about 1.25 MHz of the lower sideband, get transmitted. The system is known as *vestigial sideband* transmission.

(to page 33) ▶

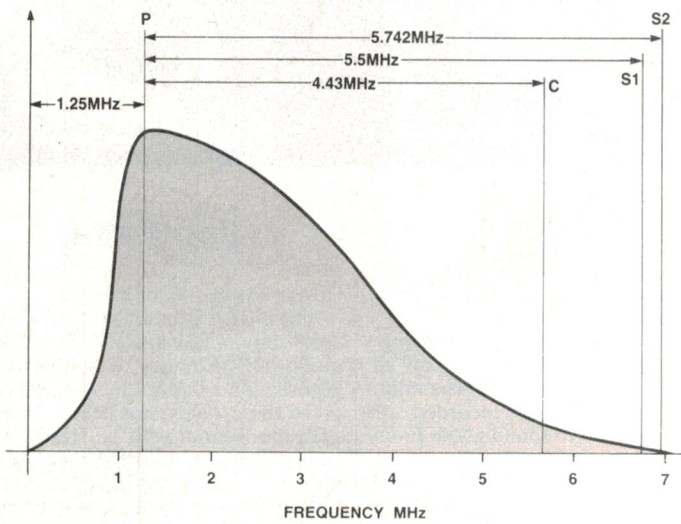


Diagram 1. Make up of Australian TV channels. The channel 'bottom edge' is at far left. The vision carrier is at P, the colour carrier at C, and the two sound channels at S1 and S2. The curve shows the relative strength of the average video signal modulation.

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Reliability and expertise in customer service.

Ace Electronics was formed to meet the specialised needs of the electronics industry in Australia today. We live in exciting times of potential growth, where automation and sophisticated data collation, retrieval and control have an increasingly important role in business management at all levels.

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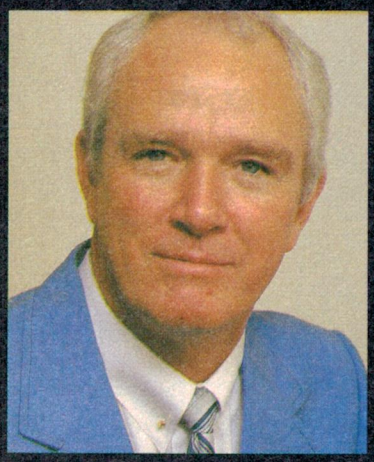
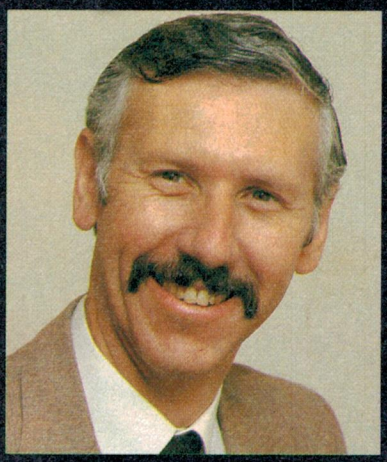
TREVOR EVANS -
General Manager
Highly experienced in electronics component parts, sales and supply. Entered the industry in Britain with Electronic Engineering qualifications before representing major companies, such as RIFA, STC and PLESSEY in Australia, marketing connectors and semi-conductors for 17 years.



LES SHORT
After gaining trade qualifications, spent 12 years as a service technician and manager. Put this practical and theoretical insight to good use with PLESSEY and UTILUX in sales representation for 14 years before coming to Ace Electronics.

PETER STEEL
Impressive track record in the industry since he gained college qualifications in Electronics and Communications. From Purchasing Officer in Mining and Manufacturing, spent 11 years with AWA and EMI in electronics, and a further 9 years with RIFA as a sales representative before joining Ace Electronics.



NARELLE BOWER
Hails from Dubbo and, post studies at a metropolitan business college, gained 3 invaluable years experience in customer liaison with an import, manufacturing and distribution company as a Secretary and Administrator.

SUE TINYOW
A Sydney Accountancy student with already more than 4 years experience with import and export companies in the electronics industry. Handles Ace Electronics extensive stock control and other computerised systems like a veteran.

A new name behind the top electronic products in Australia.

Ace Electronics - established to bring the latest electronic technology and components of world industry leaders to your fingertips. We already represent Robinson, Nugent , Fairchild, Taiwan Liton and Dowty UECL and have orders placed initially for over one million devices.

But that's just the start. Negotiations with other international component manufacturers are increasing our impressive inventory - arguably the largest offered by any single supplier in Australia. Details of these new agreements will be released immediately they are finalised.

Our financial resources ensure that our service to the electronics industry in Australia will be long term. We're here to stay. You can count on it. Whether your particular need as a designer or engineer is a micro-chip from Maryland or an actuator from Albuquerque we can save you time and money. Our on-line warehouse and fully computerised stock and accounting system puts a comprehensive choice of electronic components and computer products from world-wide manufacturers on your doorstep, backed by staff who are fully familiar with the latest American, European and Asian advances.

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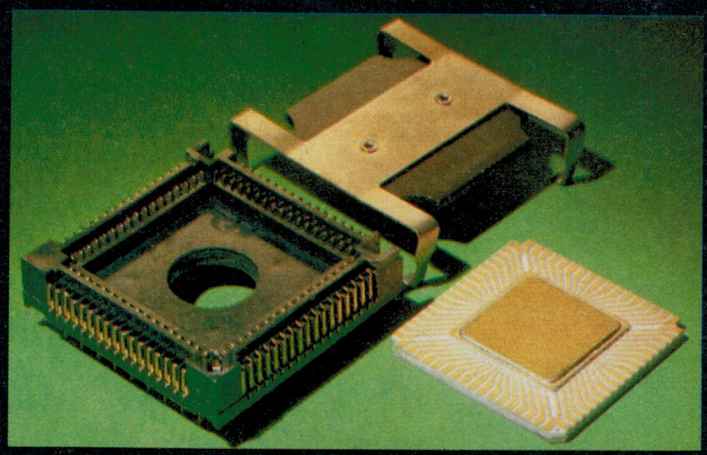

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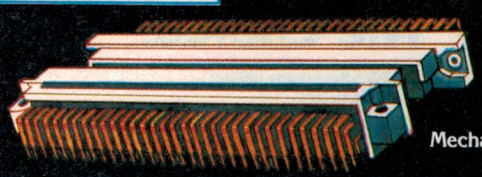

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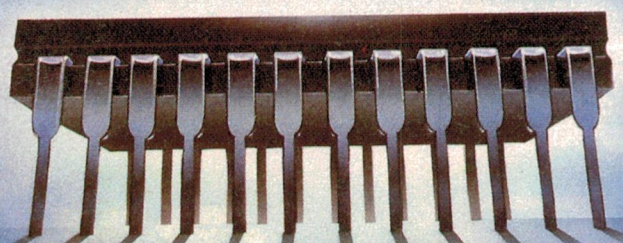

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"D" SUB MINIATURE CONNECTORS: Popular all plastic versions, both male and female types.

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CABLE PLUGS: Available with strain relief and retaining clips for rugged applications.

CABLE: Five styles available: standard grey, color coded, ground plane, ground plane with drain and shrouded jacketed.

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Vestigial transmission has a number of advantages. Firstly it reduces the bandwidth required for the channel to a satisfactory 7 MHz. As a bonus, it also concentrates signal power in the low video frequencies where the most important video information is located.

The upper sideband, as already mentioned, contains all the luminance information necessary for the creation of a monochrome picture. The colour information is carried on a sub-carrier at 5.68 MHz from the channel's bottom edge. The sounds information is also on a sub-carrier, located at 6.75 MHZ from the channel edge.

The German system involves placing another carrier at 6.992 MHz from the channel bottom and then decoding it in exactly the same way as the 6.75 MHz carrier. Whatever else may be said of it, this way of doing things ensures that the two sound signals have exactly the same characteristics.

Both the sound carriers (called Sound 1 and Sound 2) are frequency modulated, the maximum deviation being 75 kHz. The bandwidth of the baseband signal is 40 Hz to 15 kHz. Sound 1 is transmitted at a level 13 dB below the picture carrier. Sound 2 is 20 dB down. This difference in level reflects the fact that both sound carriers are crowded into the top of the channel, and care has to be taken to stop the second sound carrier from interfering with the adjacent channel higher in frequency.

The processing of the two sound signals is done in an entirely conventional way. The only difference is that additional circuitry is needed for the second IF strip, the audio detectors two-channel decoding and amplifiers.

The demodulated picture carrier information is available at the video detector. From here it is fed to the various sections for processing. The sync separator seizes the sync pulses, the video amplifier the luminance information and the chroma amplifier the colour information. The sound is picked off by two resonant circuits, the traps.

Since the sound carriers always have a constant relationship to the picture carrier, they will 'beat' with it in a constant manner, irrespective of the channel of reception. For Sound 1, this is 6.75-1.25 MHz = 5.5 MHz. For Sound 2, this is 6.992-1.25 MHz = 5.742 MHz. By tuning the traps to these values it is possible to select both carriers, and then to further select and amplify them in IF amplifiers.

In order to obtain the baseband sound signal it is now necessary to demodulate the output of each IF stage, just as in a radio. Usually this is done by a ratio or quadrature detector. The output from the detector can then be fed to the stereo matrix decoder.

The matrix encoding of the signal is necessary because the stereo signal is not sent as left (L) and right (R) channels, but as (L+R) and R. This is done so that mono receivers can still receive the full sound system on the first sound carrier (L+R), thus retaining compatability. These two signals are fed into the matrix where the appropriate subtraction is done to derive L and R.

One of the main advantages of this way of doing things is economics. Stereo transmission is simply an add-on to existing equipment and facilities. In the domestic receiver it means no more than the inclusion of a few components. (But that's not the same as saying that stereo TV sets will be cheap). The commercial television stations have leapt at the chance to increase their appeal and in the first six months of licencing, the Department of Communications has licenced five stations: Channel 9 in Sydney, Melbourne and Perth, ATN 7 in Sydney and WIN 4 in Woollongong.

The public broadcasters have been a bit more conservative. Both the ABC and the Special Broadcasting Service (SBS) are acquiring the equipment necessary to record two-channel sound, but government sponsored restraint, and concern about the standards adopted, has made them hesitant.

The SBS, of course, has a special interest in stereo because of the possibility of becoming the world's first multi-language transmission channel (as well as the world's first multi-lingual, if you see the difference).

The dual carrier method of stereo broadcasting gives a worst-case cross-talk figure of 40 dB, according to the Department of Communications. While not spectacular by modern hi-fi standards (compact disc players are quoting 80 dB these days), it is sufficient for the job the SBS require of it. Thus it would be possible to use one channel for an original programme voice track, and the second sound channel for an English translation. Current SBS policy, however, is that this would be limited to foreign language documentaries. French film buffs can relax. ●

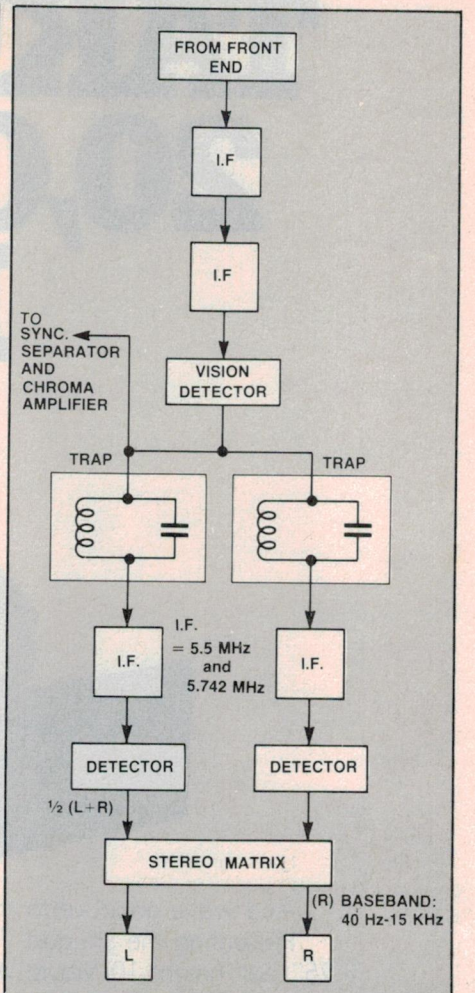

Diagram 2. Detecting the dual carrier sound system to produce stereo or dual-channel sound.

. . . AND THE US GOES ONE BETTER

THIS MONTH, television broadcasters in the US plan to start transmitting stereo sound. But the technology they're going to use will be quite different to the Japanese, British and German systems (the last of which has been adopted here). The US system will allow no less than *three* channels of sound to be transmitted — two channels for stereo and a third channel for separate audio programming, such as a foreign language.

In addition, a noise reduction system will be employed to improve the signal-to-noise ratio on the sound channels. This will be a system from the Massachusetts-based firm of **dbx** which makes noise reduction systems for hi-fi equipment (tape recorders in particular). All US TV manufacturers will have to take a licence under patents to dbx. This, along with the different technology, is hoped to shield the manufacturers against heavy foreign competition.

In the US system, the normal sound carrier signal will convey mono sound (R+L) that can be received by any of the existing 130 million sets. A sub-carrier will provide the extra information needed to produce stereo sound (left and right), rather like the Japanese approach. A *second* sub-carrier at a much higher frequency provides for the third audio channel. This channel can carry complementary commentary to the stereo programming in another language, for example, or sound dubbed from a foreign film.

The twin sub-carrier system, transmitted in the space originally allocated for the mono sound carrier, caused problems of background hiss and whistle. By treating the two added sub-carriers with a modified version of the dbx noise reduction system, developed to reduce tape hiss, the problem is overcome. At the transmitter, quiet sounds are made louder before being broadcast so that they stand proud of the background mush. A 'mirror' circuit in the receiver cuts them back by the same amount, so losing the mush.

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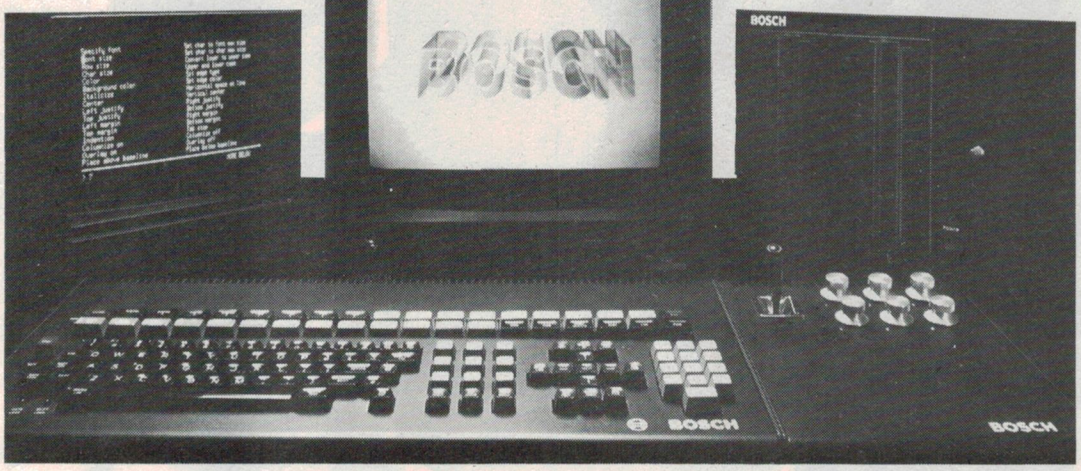


The Bosch FGS 4000. A video graphics machine on display at the SMPTE conference.

Conference Conflict

The Society of Motion Picture and Television Engineers (SMPTE) held their first international conference in Sydney recently. Jon Fairall reports.

THE CONFERENCE was devoted to a discussion of the new technologies that will affect the production of film and television in the near future. One of the major themes to emerge was that the fight between film and electronic techniques continues.

Much was made of the increasing flexibility of video gear. Ray Mobsby from the BBC gave an account of experiments his organisation has been conducting on replacing film units with video. It seems that while the lightness of video gear is a positive boon to cameramen, there were many complaints, particularly about the amount of noise they generate.

To counterpoint the arguments of the video enthusiasts Eastman Kodak rolled out some of their new lo-light film stocks that offer an extraordinary ability to film in ultra low light. The point was made, and emphasised by some stunning visual presentations, that film has a far greater flexibility and higher definition than video. For instance, a contrast range of 400:1 is average for the latest generation of film, but video can only manage 50:1. A 35mm film frame contains 4.9 million pixels, versus the few hundred thousand on broadcast television. Even the proposed high definition TV standards would not approach these figures.

On the other hand, video has a far greater capacity to generate special effects and graphics than film. A number of speakers demonstrated the versatility of new animation and graphics generating machines. Highlights of the show were the Bosch FGS 4000 and the Fairlight Video Synthesiser. Doug Harrison from Bosch showed a demonstration tape produced on the FGS 4000 that featured some remarkable colour graphics. It demonstrated to any remaining doubters that these machines will become an indispensible tool in the advertising, music and TV industries.

Even in this area though, film has some remarkable abilities. Peter Parkes, the director of Oxford Scientific Films, showed off some of the remarkable effects he has achieved by filming the very small, the very fast and the very slow. It turns out that it is possible to fool all the people all the time, as his work on Pink Floyd's 'The Wall' and Ken Russell's movie 'Altered Stats' has shown.

The *enfant terrible* of the movie industry, Gareth Brown, was also out in force with his latest invention. He calls it the Skycam, and it consists of a camera, with associated guidance and control systems, suspended from wires. The idea is that the four suspension wires are run through pulleys attached to the highest extremities of a sports ground, e.g: the tops of flood light towers or grandstands. By winding the appropriate wires in and out the camera can then be guided to any point in the stadium, at any height up to almost the level of the pulleys. The length of the wires is controlled by motors which are themselves controlled by a microprocessor responding to a joystick control. The processor is also used to control servo motors on the unit that keep it steady and control pan and tilt. A demonstration tape produced on the Skycam showed that, inspite of the Heath Robinson-ish sound of the invention, it does, in fact, add a quite striking view to sports coverage.

Other speakers at the conference looked at some of the changes that will be affecting Australian TV in the next few years. Satellite transmission occupied a lot of attention, as did Teletext and associated text transmission systems.

Ted Thomas, General Manager at ATN 7, underlined Australia's contribution to the development of practical broadcast systems with a catalogue of achievements over the last few years. The Racecam system is probably the most spectacular. Racecam is a camera mounted in a racing car, together with associated transmission equipment. It has been successfully transplanted to the US where the CBS network now use ATN expertise in this area. Another area where considerable advances have been made is the use of helicopters, especially as mobile relay stations.

Mr Thomas said that the single most pressing problem which management of TV stations could give to engineers was the development of a storage method for films and videotape. He said that the amount of space needed for storage of the accumulation of years of transmission material was becoming a major financial burden on TV stations around the world. What we need, he said, is the ability to store an hour's worth of programme material on something no bigger than a credit card. ●

TOPO

A Walking, Talking Robot

An apple for TOPO? The robot is controlled through a computer interface and infrared transceiver system (spaceship-looking thing at far left). Software for Apple II is only available at present.

Dennis Lingane

MANY YEARS AGO, a machine such as TOPO was only seen in the movies or was controlled by huge banks of computers. With the incredible increase in technological know-how the machine of the year 2000 is now with us — or is it?

TOPO is a computer-controlled robot costing around $3000. That puts paid to the affordable part. But then that's only one aspect. And it might change if production increases.

After all, we are always being told how calculators and computers are now a fraction of their original price. When the hand calculator came out it had addition and subtration and cost well over $300.

Now the calculator has trigonometric functions, displays letters of the alphabet, is as thin as a credit card and is solar powered. And it costs less than a night at the movies.

If the robot technology is refined at the same rate then we may see an affordable robot by 1990.

But back to the present. TOPO is the offering and unfortunately it really isn't much more than a big electronic toy — although that could change if the inventors keep working on it.

Rocking on

TOPO has a new system of movement which consists of two wheels which sit at an angle of 30 degrees to the horizontal. This new system is called Andromotion. A novel idea which certainly works efficiently. It enables TOPO to turn on the spot or turn through any desired angle.

The only problem with a robot having wheels is that your home must have ramps between all levels so it can visit all the rooms. This is a fault in all robots that use wheels as transportation.

But this style of wheel is certainly a lot more reliable and efficient than that used by previous robots which had wheels like shopping trollies and usually went where they wanted to, rather than where you wanted.

The sloping wheels enable TOPO to turn on the spot and very accurately at that. But there is a problem with forward and backward movement.

When moving forward TOPO has no front wheel for balance so it has a tendency to rock backwards and forwards. This unsteady movement is TOPO's main weakness. However, it is only a prototype problem and will most probably be fixed in later models.

Even though the rocking movement is only slight it stops TOPO from carrying objects. We had visions of it fetching coffee for the office staff, but most of the coffee was spilt on the floor so we eventually had to fit TOPO with flippers.

However, Androbot has found a way around this. Put the drink in a can — and our editor agreed, nodding happily at the thought of a Fosters for morning tea.

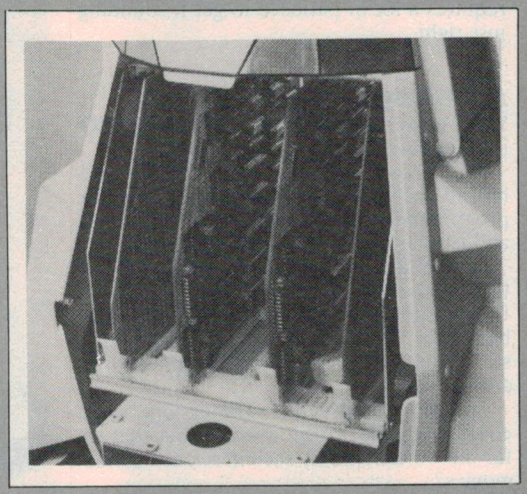
The TOPO hand is shaped to carry cans; in fact, in Chicago at the Electronics Show last year BOB (the most intelligent member of TOPO's family) was able to waddle to a special fridge, collect a cool drink and bring it back.

Theoretically, TOPO can do the same trick but you'll need to buy the special Androbot fridge.

TOPO is a friendly creature. When you turn it on it answers by repeating its name four times, followed by a big hello in a southern accent.

On the top of its head is a switch pad. This is for when you do not have a computer. It allows TOPO to behave like a radio controlled car. When you press the button

At the moment this computer-controlled robot isn't much more than a big electronic toy. It doesn't wash windows, but it is a programmer's dream come true. Promised add-ons will make it less of a gimmick and more useful.



Above. The electronics slots inside the robot's body.

The guts of the matter. At left is the founder of Androbot Inc., Nolan Bushnell, who started the giant Atari company. He's with BOB (for Brains On Board), TOPO's up-market sibling.

Traction system. The unusual drive system puts the wheels at 30° to the horizontal, giving exceptional lateral stability.

at the front of its head it pronounces the word 'forward' and commences forward motion.

When pressing the left and right buttons TOPO pronounces the corresponding word and turns in the correct direction. To stop it you press the rear switch and it says 'stop' and comes to a halt.

TOPO can also combine the three major functions, forward, left and right, together so that it arcs to the left or right.

You might think that is a rather expensive way to do nothing significant. It is from these basics that TOPO can do more of the type-cast robotic chores. It is true that on its own it doesn't do much and it is more like a radio controlled car. However, when you plug it in to your computer the world is your oyster.

Speak to me

At the moment TOPO only runs on an Apple II with 48K of RAM, using the Super Serial card with an RS232 interface. But programs will soon be available for the Atari and Commodore computers.

When plugged into a computer TOPO can say anything you want. It does this with a phonetic alphabet which it uses to analyse what you typed in.

This format has its faults. To say a word like psychiatrist TOPO must read it as "sy ky uh trist". This is no different to most voice synthesisers. The problem will arise when ordinary people want to use the speech facility. They might find it rather difficult to find the set of letters which makes the right sound.

Androbot has come to their aid, to a degree, by including several tables of the correct letter sequence so you can create the right sound. These tables will be vital to the novice user of voice synthesisers.

The advantage of using phonetics is that TOPO is multilinguial. It can speak in many languages such as French, German, Spanish, Italian, Chinese, Japanese and Arabic. No matter where you are in the world TOPO will 'parlez-vous'.

TOPO can be programmed using a language called TOPOSOFT. It is very similar to Logo but was originally developed as a FORTH-based applications program. It adheres very closely to the FORTH-79 standard, and was written to be easy to transfer to other computer systems.

If you want TOPO to move fifty centimetres forward then you type in '50 FWD'. If you want it to turn 117 degrees to the left then type '117 left'. Simple, isn't it?

Whole statements can be strung together by placing spaces in between each command. You can name such procedures, then every time you call the name TOPO will go through that procedure.

Commands such as GET-POSITION and SET-SPEED can give the programmer a great deal of control over TOPO. The commands can test for which switch is being pressed on its head, test to see if TOPO is talking or not, and so on.

Applications which TOPO is capable of include teaching in an educational situation, going to the bar and getting a drink, escorting guests to the dinner table and vacuuming the floor.

That's some of the things that TOPO can do, but what can't it do?

Well, he can't wash windows, but who wants to?

In brief, TOPO is not ready for the average home user, as indeed the average home user is not ready for TOPO. And neither is ▶

their home, unless it has ramps instead of stairs. TOPO cannot travel between rooms of different levels which do not have ramps joining them.

Its arms are not really capable of carrying unusual or heavy objects. Its batteries only last several hours before they need recharging. And it has a voice synthesiser which requires a lot of patience to get it sounding just right.

A gimmicky toy?

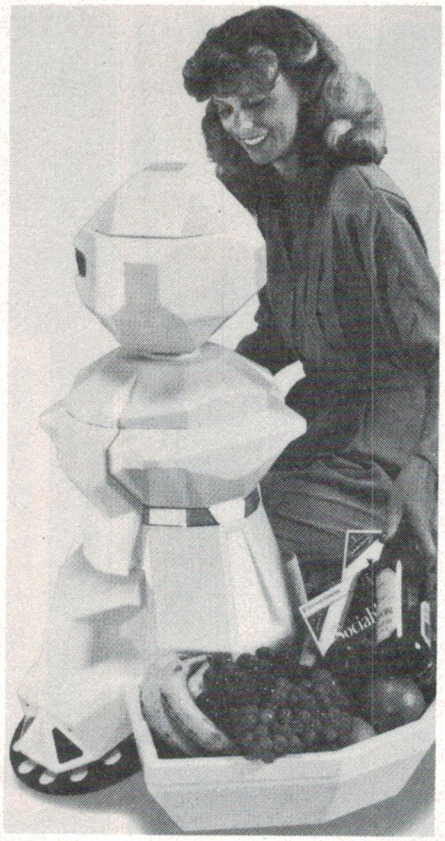
With its faults some might think that TOPO is an overpriced toy.

But it is cute looking, good with kids and has all the patience in the world. It is the programmer's dream come true. It is light and can be carried from room to room.

Special devices will eventually be built so that it can carry heavy or unusual products. In fact, there is a robot trolley that fits to its back for carrying shopping; this also steadies the robot in its rocking and rolling during motion.

It might need some refining but what could you expect from a world-first that so far the world has only seen in science fiction movies?

Wasn't the Apple first considered to be a millionaire's toy when it first came out? The fact that this robotics company is headed by the US electronics industry's leading entrepreneur, Nolan Bushnell, (who started Atari in a garage in Silicon Valley and then sold it a few years later for $27 million to Warner) is an indication that this company has the talent to convert science fiction to reality.



Home, Jeeves! TOPO with the special carry cart.

Bushnell himself admits that his robots are a bit of a gimmick now. But he promises that new add-ons will follow to make them less of a toy.

These add-ons will be for TOPO and its big brother BOB. BOB has a microprocessor on board so that it doesn't need to be in constant sight of an infrared remote control module.

I leave you with a quote from the manual (due to its length some of it has been omitted): "In 1950 science fiction author, Isaac Asimov, published a book called 'I, Robot'. In the introduction Asimov stated that the major manufacturer of robots would be in existence in 1982.

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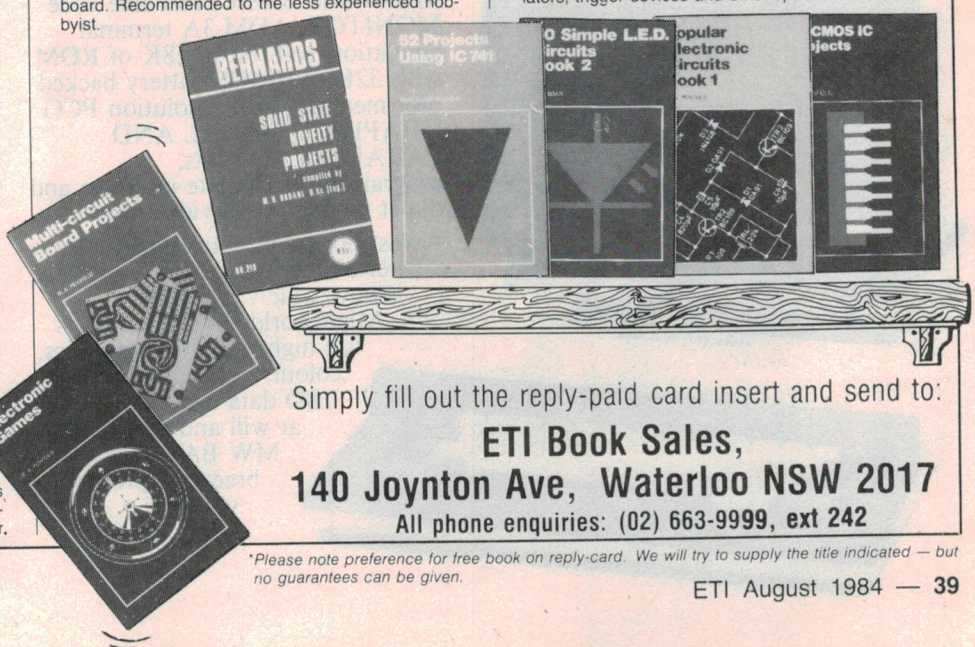

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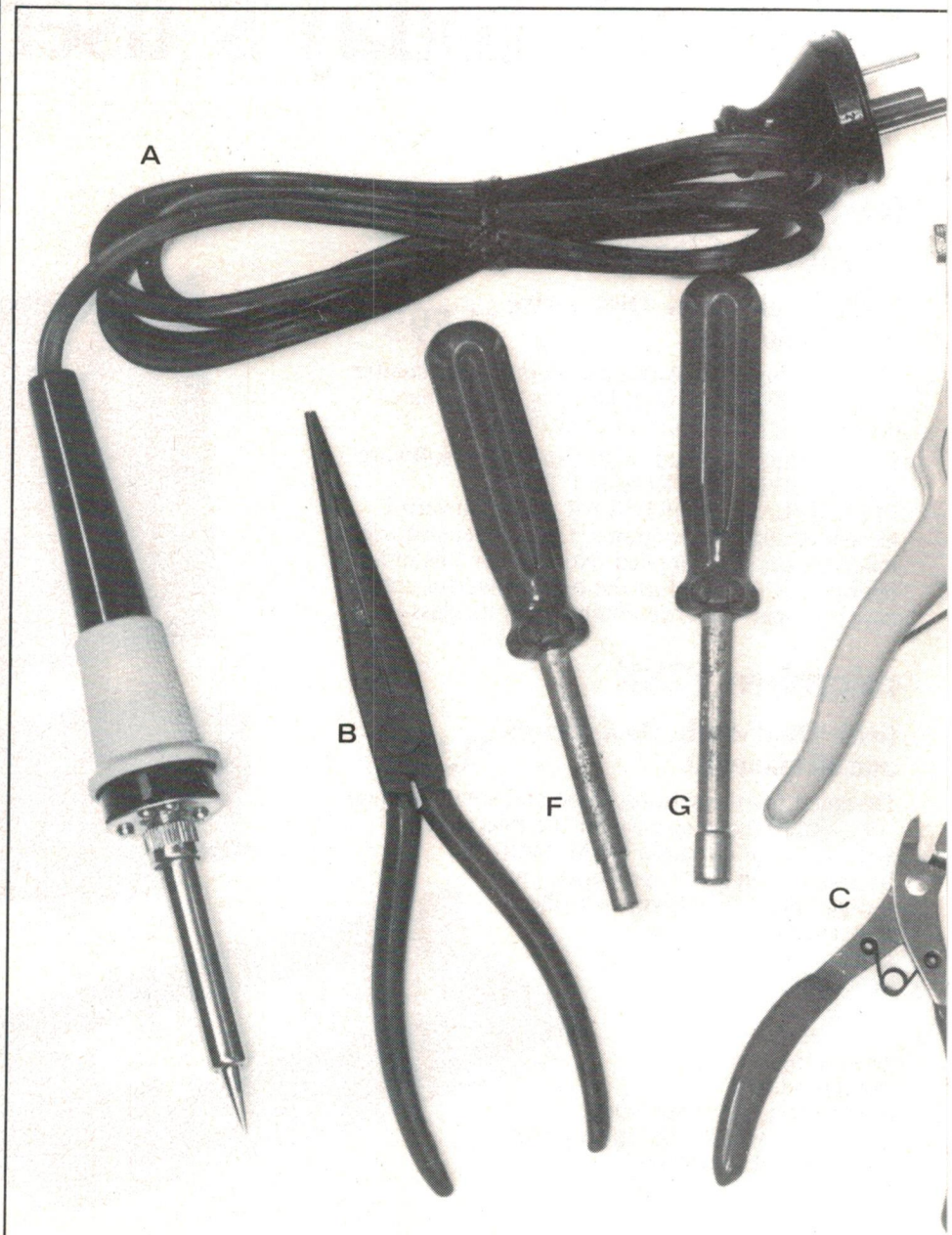


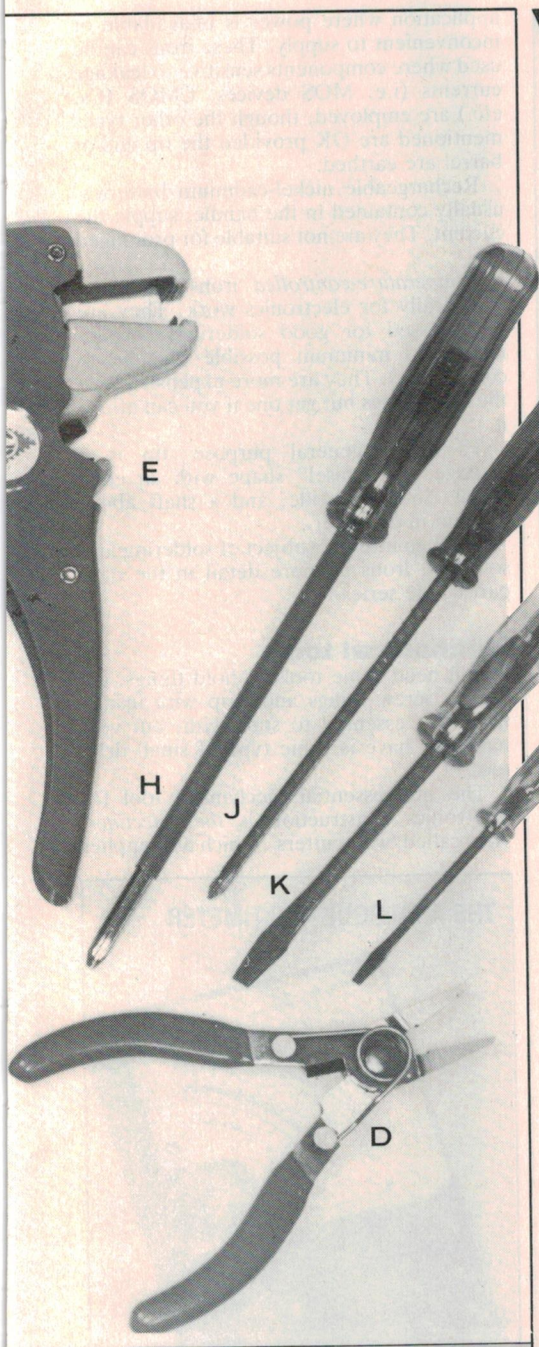
YOUR BASIC TOOLKIT!

Here are pretty well all the basic tools you'll need for constructing electronic projects. On the left (A) is a low-cost 20 watt continuous-heat soldering iron. In the foreground are long-nosed pliers (B), side cutters (C) and snub-nosed pliers (D). At top-centre is a "Tyrannosaurus" wire-stripping tool (E) — an extremely handy and time-saving device. To the left of it are two nut drivers (F-G) and to the right are four screwdrivers — two Philips-head types (H-J) and two flat-blade types (K-L). All you need add perhaps is a small drill and a 'hobby' knife.

YOUR BASIC TOOLKIT

Want to 'get started' in electronics? You've come to the right place! This elementary series *shows* you how to get into the fascinating hobby of electronics without the necessity of having mountains of money, unlimited time or a university degree.

Roger Harrison



[Soldering iron courtesy Altronics, Micron T2420; Wire stripper courtesy Jaycar, TH-1824; sidecutters and snub-nosed pliers courtesy Dick Smith Electronics, T-3205 and T-3565 respectively; other tools courtesy of local hardware store]

WELCOME TO the wide, wonderful world of electronics! Once you've 'dabbled' a while with a project or two and enjoyed the satisfaction of putting together a project *yourself*, and got it working, you'll be *hooked*. Join the millions of hobbyists worldwide. Electronics must surely rate as the world's biggest, most popular hobby. Virtually everybody employed in any aspect of the electronics industry either started out as a hobbyist — or is employed pursuing their hobby!

Well, where *do* you start? For the beginner starting out in electronics (. . . good name for a series!) it can seem bewildering when you're confronted by a profusion of terms and phrases — seemingly like another language. How do you sort out a resistor from a capacitor, a transistor from a transient, an electron from an electrolytic, or a printed circuit from a polypropylene capacitor? Well, that's our job. This series is designed to introduce you to the 'bits' and 'how to' of electronics with as little pain as possible. You learn as you go. You can start by tackling relatively simple projects at first, learning how to use the tools as you proceed.

Now that seems like the best place to start — with the tools.

The soldering iron

Electronic components are connected to conductors, tags, terminals etc, by *soldering*. Solder is an alloy of tin and lead, mixed in the ratio, for electronic applications, of 60:40. It melts at a temperature lower than the melting point of either metal alone, that temperature being around 188° C. A soldering iron is used to heat the parts to be joined and melt the solder so that it covers the joint. The solder acts as filler and bonding agent, creating an electrical contact between the parts being joined and filling the irregular surface.

To make a proper bond to the joint, the solder has to 'wet' the surfaces.

As metals oxidise, or tarnish, on the surface as a result of being exposed to air, 'flux' is used to remove the tarnish. For electronic work this is composed of resin (sometimes spelt rosin), which is obtained from the sap of pine trees plus additives called 'activators'. At soldering temperatures, the activators decompose, liberating an acid that dissolves the tarnish faster than pure resin. Other fluxes are also made for non-electronic uses, usually sheet-metal work, copper and brass-ware manufacture. These fluxes are usually highly corrosive (such as hydrochloric acid) and must *never* be used for electronics work as even minute amounts rapidly corrode component leads and printed circuit board tracks.

Solder for electronics work is made as different gauge wires, most have a resin core along their length, some have up to five separate cores.

The resin core melts before the solder ▶

GET THE DRILL?

A small, handheld 'mini' drill, having a chuck speed of 5000 to 10 000 rpm is handy for drilling holes in printed circuit (or 'pc') boards. Ready-made pc boards have pre-drilled holes so a drill is not essential to start with, unless you go 'the whole hog' with your projects and make your own boards. (We'll show you later).

and flows onto the joint, wetting both the joint and the solder, excluding the air. At the same time the activators dissolve the tarnish on the surface, allowing the solder to flow freely and properly wet the joint. When the solder melts, the increase in temperature deactivates the flux, limiting the possibility of corrosion.

Resin-cored solder is obtainable in a variety of wire gauges. For general and heavy work, such as on sockets, chassis, switch contacts, etc, 16 gauge is suitable. For fine work on printed circuit boards, miniature components, etc, 20 or 22 gauge is best. It pays to have several different gauges handy. Experience will show which is the best under different circumstances.

It is important to select a suitable soldering iron — after all, it will probably be the tool you use the most! A bewildering variety of types and sizes are available.

The most suitable rating for electronics work is between 15 and 30 watts. Irons below this rating generally do not have sufficient heat capacity, while those above have high tip temperatures that can result in damaged components and poor joints. Irons of the *continuous heat* type, that have ratings above 80 watts, are best for sheet metal work. Irons advertised as 'universal' (mostly having a rating of 40 or 50 watts) should be avoided as they are usually too bulky for electronics work, particularly on printed circuit boards, and have too much heat capacity and high tip temperatures with the likelihood of component damage. The handle also usually gets too hot for comfort.

Choose an iron which is comfortable to hold. As well as being light, the iron should preferably have a lightweight power cord to reduce drag on your wrist when moving the iron around. The length of the cord should be adequate — about 1.5 m to 2 m is a good length.

Low wattage, continuous heat irons are probably the most widely used despite a few drawbacks. They are heated by a wire resistance element located in the barrel just behind the tip.

Continuous heat irons are slow to heat to soldering temperature — they are usually left running continuously. This causes tip oxidation which therefore requires constant maintenance and fairly frequent replacement. These are minor drawbacks, however, if you cannot afford a more expensive iron.

Some irons of this type are obtainable with a temperature select switch in the handle. This usually doubles the power when needed to provide sufficient heat to make the occasional heavy joint. They are normally used on the lower power position for routine soldering.

Quick-heat irons operate from a low voltage at a high current, usually supplied from a transformer, and take only a few seconds to reach soldering temperature. They take only a few more seconds to reach red heat if the operating button is held on too long!

Quick-heat irons are made in two basic styles — the soldering gun and the low-voltage iron.

Quick-heat irons are suitable for intermittent handyman use or applications requiring their large heating capacity. They are not recommended for general electronics use, particularly on printed circuit boards, except perhaps for the 'mini' models. Quick-heat irons require some skill to control the heat so as not to damage components by overheating.

Despite their limitations, quick-heat irons can be useful in an electronics workshop. If you contemplate purchasing one make sure the transformer has an electrostatic screen.

Soldering guns have the disadvantage that the transformer in the handle tends to make them a little unwieldy, especially for prolonged use.

Battery-operated soldering irons have become widely available, and these find application where power is unavailable or inconvenient to supply. These irons can be used where components sensitive to leakage currents (i.e: MOS devices, CMOS ICs, etc.) are employed, though the other types mentioned are OK provided the tip and/or barrel are earthed.

Rechargeable nickel-cadmium batteries, usually contained in the handle, supply the current. They are not suitable for prolonged use.

Temperature-controlled irons are made specifically for electronics work. They are unsurpassed for good soldering, convenience and minimum possible damage to components. They are more expensive than the other types but get one if you can afford it.

The best 'general purpose' tip is a "wedge" or "chisel" shape with an edge about 2.5-4 mm wide, and a shaft about 5-7 mm in diameter.

We'll go into the subject of soldering and soldering irons in more detail in the next part of the series.

Mechanical tools

You'll need some tools to hold things, cut things, screw things and strip wire insulation. Not essential to start with, but very handy to have is some type of small drill, too.

The quintessential mechanical tool for electronics construction is *the sidecutter*. Also called 'wire cutters', which also applies ▶

THE ANALOGUE MULTIMETER

These were the 'standard' test instrument for many years. Multimeters are used to measure the basic quantities involved in electronics — voltage, current, resistance. Analogue multimeters cost anything from as little as $10 to over $100. This Univolt model from Benelec costs around $20.

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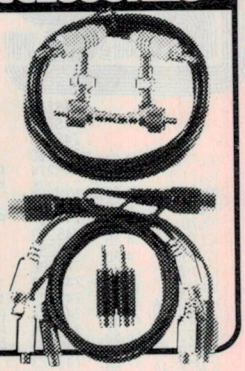

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74LS368	1.00
74LS373	2.00
74LS374	2.00
74LS375	1.00
74LS377	2.15
74LS378	1.20
74LS379	1.90
74LS386	1.00
74LS390	1.80
74LS393	1.80
74LS395	2.00
74LS396	2.50
74LS398	3.00
74LS399	1.90
74LS424	5.50
74LS440	5.50
74LS441	5.50
74LS442	5.50
74LS443	550
74LS445	2.20
74LS446	5.50
74LS447	1.90
74LS448	5.50
74LS449	5.50
74LS490	3.20
74LS540	5.95
74LS541	7.95
74LS621	2.75
74LS622	2.75
74LS623	5.95
74LS629	5.95
74LS640	3.95
74LS641	2.75
74LS642	2.75
74LS643	2.75
74LS644	2.75
74LS645	2.75
74LS668	1.75
74LS669	1.75
74LS670	2.75
74LS673	12.55
74LS674	12.55
74LS690	3.95
74LS691	3.95
74LS692	3.95
74LS693	3.95
74LS696	3.95
74LS699	3.95

CDP

CDP1802	16.50
CDP1864	17.50

CPU

6502	13.00
6502A	14.00
6503	13.00
6504	13.00
6505	13.00
6507	13.00
6520	5.50
6521	5.90
6522	13.00
6522A	13.00
6532	14.00
6545	22.50
6551	12.90
2650	21.00
2651	23.00
6800	8.00
6802	10.00
6808	12.50
6809	17.00
6810	3.50
68B10	
6820	5.50
6821	5.50
68B21	
6840	6.50
6844	15.00
6845	25.00
6847	7.50
6850	3.50
68B50	
6860	10.00
6875	15.50
Z80CPU	7.00
Z80ACPU	8.00
Z80BCPU	16.00
Z80P10	4.50
Z80AP10	6.50
Z80CTC	6.50
Z80ACTC	8.50
Z80DMA	16.00
Z80ADMA	19.00
Z80AS10	15.00
Z80S10	13.00
AD570	69.50
AD590	9.50
AD7524	17.50
AY-3-8910	14.50
AY-3-2513	14.50
MSM5832	16.50
MM58174	19.50
MM5303	7.50
MM5309	14.50
MM5369	4.95
LH0002	9.50
LH0042CH	7.50
LH0070	7.50
LH0071	7.50
TL061	1.50
TL062	2.90
TL064	4.90
TL071	1.20
TL072	2.90
TL073	3.20
TL074	4.90
TL081	1.90
TL082	2.50
TL083	2.90
TL084	3.45
TL494	4.90
TCA220	9.50
TCA280	4.50
TDA1024	2.90
TA7205P	3.90
TEA1002	17.50
UAA170	5.95
UAA180	3.75
LM10CH	7.50
LM301	1.00
LM301H	1.50
LM302H	6.50
LM305H	1.50
LM307CN	1.00
LM307H	1.60
LM308	1.20
LM308H	1.80
LM309K	1.90
LM310N	3.20
LM310H	3.20
LM311	1.00
LM311H	1.80
LM317T	2.50
LM317K	4.50
LM318	3.50
LM318	3.50
LM324	1.50
LM325	4.50
LM326	4.50
LM329DZ	.90
LM344Z	1.70
LM335Z	2.20
LM336 2.5V	2.95
LM338K	12.50
LM339	1.20
LM348	1.80
LM349	1.60
LM350K	8.50
LM351N	1.00
LM353	2.50
LM356N	1.40
LM357	1.40
LM358	1.40
LM361	3.50
LM377	4.90
LM378	3.95
LM379-S	7.95
LM380 8PIN	1.80
LM380 14PIN	1.90
LM381	2.00
LM382	2.20
LM383	3.90
LM384	3.50
LM386	1.95
LM387A	LM3.95
LM387	2.00
LM390	2.95
LM391	2.90
LM393	1.00
LM394	4.95
LM395T	9.95
LM396K	22.50
LF398	5.90
NE544	6.50
NE555	.80
NE556	1.80
NE558	6.90
NE560	4.60
NE561	4.60
NE565	1.60
NE566	2.90
NE567	2.00
NE570	5.90
NE571	5.90
NE592	6.90
NE594	9.50
LM709-14	1.50
UA710CN	1.00
LM711	1.20
LM723	.75
LM723CH	1.50
LM725	4.75
LM733	1.50
UA739	2.75
741	.80
UA747	1.30
UA748	1.00
MC1310	9.50
MC1312	7.95
MC1314	7.95
MC1315	8.95
MC1327	7.95
MC1350	1.95
MC1408L8	7.50
MC1437	4.95
MC1445	5.95
MC1456	1.95
MC1458	1.20
MC1466L	14.50
MC1469R	6.90
MC1488	2.50
MC1489	2.50
MC1494	8.40
MC1495	8.90
MC1496	2.50
LM1596	3.00
MC1648	8.90
LM1812	10.50
LM1830	3.90
LM2907	3.50
LM2917 8PIN	3.40
LM2917 14PIN	3.40
MN3001	17.50
CA3028	2.00
CA3046	1.90
CA3056	6.50
CA3059	5.95
CA3080	1.90
CA3086	1.90
CA3089	3.90
CA3100E	7.95
CA3130E	2.20
CA3130T	2.95
CA3140E	2.20
CA3140T	2.95
CA3240E	11.95
LM3401	1.00
LM3900	1.20
LM3905	1.75
LM3909	2.95
LM3911	2.95
LM3914	5.90
LM3915	5.90
LM3916	5.90
LM3999Z	2.60
RL4136	1.95
RC4145	20.90
RC4194	3.90
MM 5369	4.95

SCR & TRIACS

SC141D	1.50
SC141E	1.95
SC142E	2.95
SC146D	2.85
SC146M	2.95
SC150D	4.95
SC151D	2.95
C103YY	.90
C103B	.90
C106B	.90
C106D	.90
C122D	2.50
C122E	2.95
C1260D	8.50
C1260E	9.90
2N2646	1.20
2N2647	2.50
2N6027	.90

TRANS.

AC125	1.20
AC126	1.20
AC127	1.20
AC128	1.20
AC187	1.50
AC188	1.50
AC149	3.40
AD161	2.90
AD162	2.90
AF118	2.90
AF126	2.90
AF127	1.50
BC 107	.50
BC 108	.50
BC 109	.50
BC 159	.50
BC 177	.60
BC 178	.60
BC 179	.60
BC 182L	.30
BC 212	.30
BC 318	.30
BC 320	.40
BC 327	.30
BC 328	.30
BC 337	.40
BC 338	.40
BC 546	.20
BC 547	.20
BC 548	.20
BC 549	.20
BC 550	.40
BC 556	.40
BC 557	.20
BC 558	.20
BC 559	.20
BC 635	.80
BC 636	.80
BC 637	.80
BC 638	.80
BC 639	.50
BC 640	.50
BC Y70	1.90
BC Y71	1.90
BD135	1.00
BD136	.90
BD137	.90
BD138	.90
BD139	.90
BD140	.90
BD201	.90
BD202	.90
BD232	.90
BD233	.90
BS235	.90
BD236	.90
BD237	.90
BD238	.90
BD262	1.20
BD263	1.20
BD437	1.50
BD488	1.50
BD647	1.80
BD648	1.80
BD677	1.80
BD681	2.00
BD682	2.00
BDV64B	5.50
BDV65B	5.50
BDX63	6.50
Y96 (BUX 80)	4.90
BDY97 (BUX 80)	4.90
BF115	1.50
BF167	1.20
BF173	1.20
BF177	1.20
BF180	1.20
BF182	.90
BF183	.60
BF184	.60
BF198	.60
BF199	.60
BF200	1.20
BF245	1.50
BF337	1.50
BF338	1.90
BF458	1.00
BF459	1.00
BF469	1.20
BF470	1.20
BF494	.90
BF495	.90
BFW10	1.50
BFW11	1.50
BFW16	1.50
BFY50	1.20
BFY90	1.90
BFX90	1.50
BU126	2.50
BU208	3.90
BU326	3.00
BUX80	4.90
MFE131	2.90
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MFE3003	6.95
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MJ802	7.50
MJ901	4.50
MJ1001	3.90
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MJ11015	14.50
MJ11016	14.50
MJ15003	6.50
MJ15004	6.50
MJ15024	10.00
MJ2501	8.90
MJ2955	1.50
MJ3001	6.90
MJ4032	12.50
MJ4035	11.90
MJ4502	6.90
MJE340	2.00
MJE350	2.50
MJE371	2.90
MJE521	2.50
MJE700	3.50
MJE800	2.90
MJE2801	3.95
MJE2955	4.90
MJE3055	3.90
MJE13005	5.90
MJE13007	7.90
MJE13009	12.50
MPF121	2.50
MPF131	2.50
MPSA05	1.00
MPSA06	1.00
MPSA10	1.00
MPSA12	1.00
MPSA13	1.00
MPSA14	1.00
MPSA20	1.00
MPSA42	1.00
MPSA43	1.20
MPSA55	1.00
MPSA56	1.00
MPSA63	1.00
MPSA65	1.00
MPSA92	1.00
MPSA93	1.20
MPF102	.90
MPF103	.90
MPF105	.90
MPF106	.90
MPF109	.90
MPSL01	1.50
MPSL51	1.50
MPSU02	1.75
MPSU52	1.90
MPSU56	1.75
MPU131	1.75
MRF221	19.50
MRF237	3.90
MRF238	19.50
MRF245	43.50
MRF421	43.50
MRF454	34.00
MRF455	27.00
MRF455A	27.00
MRF475	4.70
MRF603	19.50
MRF641	32.00
MRF646	43.00
MRF901	2.75
MPF131	1.60
TIP31A	.90
TIP31B	1.00
TIP31C	1.20
TIP32A	.90
TIP32B	1.00
TIP32C	1.20
TIP41A	1.90
TIP41C	2.00
TIP42A	1.90
TIP42C	2.00
TIP49	1.90
TIP50	2.20
TIP53	2.50
TIP111	2.50
TIP112	2.50
TIP116	2.50
TIP117	2.50
TIP120	2.90
TIP122	3.45
TIP125	2.90
TIP127	3.40
145	3.40
TIP2955	1.90
TIP3055	1.90
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2N697	1.00
2N918	1.00
2N1304	1.00
2N1613	1.20
2N2102	1.90
2N2219	.90
2N2222A	1.00
2N2369	1.00
2N2484	1.00
2N2646	1.20
2N2647	2.50
2N2894	1.00
2N2904	1.10
2N2905	1.10
2N2906	1.10
2N2907	1.10
2N3019	1.90
2N3053	.90
2N3054	1.90
2N3055	1.20
2N3096	1.20
2N3109	1.90
2N3251	1.90
2N3302	1.90
2N3440	1.80
2N3441	2.90
2N3442	3.50
2N3563	.30
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2N3565	.30
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2N3640	.30
2N3641	.30
2N3642	.30
2N3643	.30
2N3644	.30
2N3645	.30
2N3646	.30
2N3702	1.20
2N3704	1.40
2N3739	4.50
2N3771	5.50
2N3772	5.70
2N3773	5.90
2N3792	6.00

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2N4033	2.20
2N4036	2.50
2N4121	1.50
2N4123	1.50
2N4236	1.90
2N4237	1.90
2N4248	.40
2N4249	.40
2N4250	.40
2N4258	.50
2N4355	.50
2N4356	.50
2N4360	1.00
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.90
2N4427	2.90
2N4919	2.90
2N5088	1.00
2N5089	1.00
2N5139	1.20
2N5179	1.20
2N5190	2.50
2N5191	3.30
2N5192	3.10
2N5193	2.50
2N5194	2.95
2N5195	3.30
2N5210	1.50
2N5245	1.50
2N5303	8.50
2N5401	1.50
2N5457	1.00
2N5458	.90
2N5459	.90
2N5461	.90
2N5462	.90
2N5485	.90
2N5486	.90
2N5489	14.50
2N5590	16.50
2N5591	18.50
2N5641	19.50
2N5656	2.50
2N5770	.30
2N5777	1.50
2N5830	.30
2N5831	.30
2N5873	1.40
2N5874	1.70
2N5944	15.50
2N5945	18.50
2N5946	19.50
2N5961	1.90
2N6027	1.00
2N6049	1.90
2N6080	8.50
2N6083	17.90
2N6084	22.50
2N6124	1.90
2N6125	1.90
2N6130	1.90
2N6133	1.90
2N6256	14.50
2N6259	13.50
2N6274	29.50
2N6378	4.90
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1N4001	.10
1N4002	.15
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1N5400	.40
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3510	9.90

74

7400	.60
7401	.60
7402	.60
7403	.60
7404	.60
7405	1.00
7406	1.00
7407	1.00
7408	.60
7409	.60
7410	.60
7411	.70
7412	.70
7413	.70
7414	1.20
7415	.70
7416	1.20
7417	1.20
7420	.60
7421	.80
7422	.80
7423	.90
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7426	.70
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7430	.70
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7443	1.60
7444	1.50
7445	1.50
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7447	1.20
7448	1.20
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7450	.90
7451	.90
7452	.80
7453	.70
7454	.80
7455	.90
7460	.70
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7462	1.00
7463	1.20
7470	.80
7472	.90
7473	.90
7474	.70
7475	.70
7476	.80
7477	1.20
7478	1.20
7480	1.20
7482	1.80
7483	1.10
7485	1.20
7486	1.20
7489	3.90
7490	1.00
7491	1.00
7492	1.00
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7495	1.00
7496	1.50
7497	2.30
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74107	1.20
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74110	1.50
74111	1.50
74112	1.50
74113	1.50
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74120	1.95
74121	.90
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74123	1.50
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74126	1.00
74128	1.80
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74136	1.00
74138	1.80
74139	1.50
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74142	1.45
74143	1.45
74144	3.90
74145	1.45
74147	1.95
74148	2.00
74150	1.50
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74154	1.75
74155	1.20
74156	1.70
74157	1.00
74158	1.00
74160	1.00
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74162	1.20
74163	1.40
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74246	2.25
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74253	1.10
74257	1.50
74258	1.50
74249	2.45
74273	2.45
74276	2.45
74278	3.45
74279	.85
74283	2.45
74289	3.25
74290	.90
74293	.90
74295	1.65
74298	2.45
74299	1.75
74351	1.85
74352	1.85
74365	1.50
74366	1.50
74367	1.50
74368	1.50
74373	2.25
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74390	1.00
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74425	1.00
74226	1.50
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9311	1.50
9312	1.95
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9317	1.00
9318	1.00
9319	1.80
9320	1.00
9321	1.00
9322	1.80
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9328	1.10
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9338	1.45
9340	3.90
9342	1.45
9368	1.95
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9386	1.50
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75110	1.75
75150	1.20
75154	1.70
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75451	1.00
75452	1.00
75453	1.20
75461	1.20
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75471	1.20
75472	1.20
75491	1.70
75492	2.20
75493	1.45
75494	1.20
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8123	1.40
8130	2.15
8131	2.15
8135	1.20
8136	1.20
8303	1.20
8304	1.00
82S23	1.45
82S123	1.65
8311	.80
8641	1.10
8820	1.00
8830	1.20
8831	1.10
8832	1.10
8833	1.30
8834	1.90
8835	2.90
8836	2.90
1488	2.40
1489	1.90
81LS95	1.90
81LS96	2.40
81LS97	2.25
81LS98	2.25
8T26	2.25
8T28	2.25
8T30	1.10
8T96	1.10
8T97	1.50
8T13	1.50
8T14	2.45
8080	2.45
8085	2.45
8086	3.45
8088	.85
8155	2.45
8156	3.25
8185	.90
8202	.90
8203	1.65
8206	2.45
8212	1.75
8214	1.85
8216	1.85
8224	1.50
8226	1.50
8228	5.50
8231	199.00
8232	199.00
8237	39.00
8238	9.50
8243	8.50
8251	4.90
8253	7.50
8255	5.50
8257	16.50
8259	6.50
8271	89.00
8272	33.00
8273	65.00
8274	42.50
8275	38.50
8276	28.50
8279	8.50
8282	6.90
8283	6.50
8284	8.50
8286	6.50
8287	6.50
8288	25.00
8289	73.00
8291	43.00
8292	34.50
8293-10	26.50
8741	57.50
8748	35.00
8749	58.50
8755	33.50
2911	26.50
2912	27.50
2920	239.00
3205/8205	9.90
3242	17.50
3245	10.90
3628	18.50
8008-1	62.50
8031-3	29.50
8035	6.90
8039	7.90
FD1771	19.00
FD1791 (8876)	39.00
FD1793 (8877)	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50
WD2143	14.50
WD1931	22.50
WD1933	34.00
WD1983	14.75
WD1993	59.00
WD2123	26.50
WD8250	16.50
TR1602 (S1883)	8.50
TR1863	8.90
COM8116	24.00
BR1941	23.00
CRT8002A	59.90

74F SERIES

74F00	.79
74F02	.79
74F04	.92
74F08	.79
74F10	.79
74F11	.79
74F20	.79
74F32	.79
74F64	.79
74F74	.89
74F86	1.19
74F109	.99
74F138	1.79
74F139	1.79
74F151	1.79
74F153	1.79
74F157	1.79
74F158	1.79
74F175	2.78
74F181	5.98
74F182	2.73
74F189	7.44
74F190	4.86
74F191	4.86
74F194	2.41
74F241	3.72
74F243	4.34
74F244	3.72
74F251	1.93
74F253	1.93
74F257	1.93
74F258	1.93
74F350	4.34
74F352	1.93
74F353	1.93
74F373	4.84
74F374	4.84
74F399	2.78
74F521	4.22
74F533	4.84
74F534	4.84

MEMORY

2101	6.90
2102	2.50
2112	7.90
2114	2.95
3147	6.90
2708	5.90
2716	5.90
2732	7.00
2764	12.00
27128	49.00
4116	3.95
4164	10.00
6116	10.00
6164	99.00
58725 (6116)	9.00
2101 (5101)	
(8101)	7.90
5101	7.90
8101	7.90
2532	12.50

OPTO

4N25	1.20
4N26	1.20
4N27	1.20
4N28	1.20
4N29	1.50
4N30	1.60
4N32	2.50
4N33	2.50
4N35	2.50
4N37	2.00
MCT6	2.50
MCT66	6.90
MCT2	1.50
1LD 74	5.90
1LQ 74	6.50
FND357	1.80
FND500	1.80
FND507	1.80
FND800	3.50
TIL31A	2.95
TIL81A	2.95
TIL306	1.50
MAN7[illegible] (DL702)	3.50
MAN7[illegible] (DL704)	3.50
BPW50	2.50
HP5082-2811	4.95
HLMP 6620	3.95
CQY89	1.50
MOC3011	2.95
MOC3020	2.50
MOC3021	2.95

LEDS

3mm RED	.25
3mm YELLOW	.30
3mm GREEN	.30
5mm RED	.15
5mm YELLOW	.30
5mm GREEN	.30
ITEM	
RETAIL COST	
5mm ORANGE	.30
RED RECT	.30
GREEN RECT	.30
YELLOW RECT	.30
RED CHROME BEZEL	1.20
YELLOW CHROME BEZEL	1.20
GREEN CHROME BEZEL	1.20

VOLTAGE REGS

78050C	1.20
7805KC	2.50
7812UC	1.20
7812KC	2.50
7815UC	1.20
7815KC	2.50
7818UC	1.20
7818KC	2.50
7824UC	1.20
7824KC	2.50
7905UC	1.90
7905KC	3.00
7912UC	1.90
7912KC	3.00
7915UC	1.90
7915KC	3.00
7918UC	1.90
7924UC	1.90
78L 05	.75
78L12	.75
78L 15	.75
78L 18	.75
78L 24	.75
79L 05	1.20
79L 12	1.20
79L 15	1.20
79L 18	1.20
79L 24	1.20
LM309K	
(7805KC)	1.90
LM317T	2.50
LM317K	4.50
LM317HV	9.50
LM323K	6.50
LM337T	2.90
LM337K	6.50
LM338K	9.50
LM350T	6.50
LM350K	7.50
LM395K	22.50
LM396K	19.50
78H 05KC	9.00
78H 12KC	9.00
78HGKC	9.50
78P 05KC	14.50
ITEM	
RETAIL COST	
79HGKC	16.50
78S 40	3.50
MC1496L	14.50

SPECIAL FUNCTION

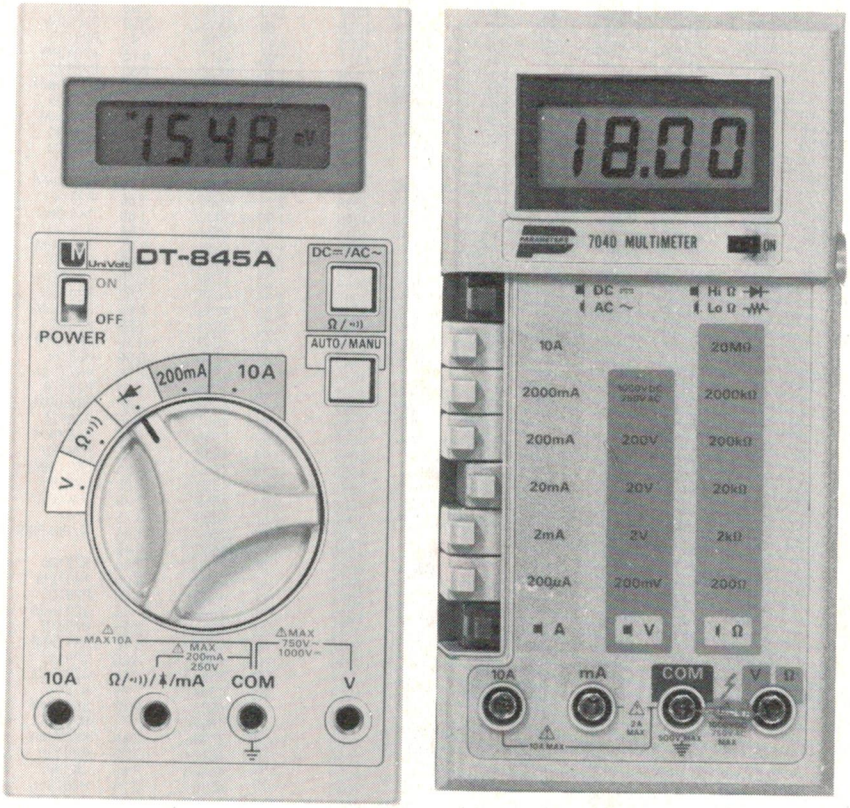
LM 4250	2.45
NE5534 N	2.50
NE5534 AN	2.95
MC3340	1.90
MC3341	2.90
76477	8.95
76488	8.95
76489	9.95
8038	6.50
OM335	22.50
OM350	10.50
IM65X08CPE	5.00
XR2206	7.95
XR2207	7.95
XR2208	6.90
XR2209	6.90
XR2211	7.45
XR2216	5.90
XR2240	6.95
XR2243	7.95
XR8038	7.50
ICC7660	12.50
95H90	8.50
11C90	16.50
LM7555	1.90
LM7556	3.50
MC10116L	1.50
LM13600	3.95
LF13741	.80
LF13741-H	1.50
DS75451	.60
DS75452	.60
DS75491	2.00
DS75492	2.00
DM2502	12.50
ADC080	16.00
ADC808	17.00
DAC0800	4.50
DAC0808	4.50
SAK140	9.50
ZN414	1.95
UA170	5.95
4000	.60
4001	.60
4002	.80
4006	1.90
4007	.80
4008	1.70
4009	.90
4010	.90
4011	.60
4012	.90
4013	1.20
4014	1.90
4015	1.20
4016	1.00
4017	1.50
4018	1.90
4019	.80
4020	1.50
4021	1.50
4022	1.50
4023	.75
4024	1.20
4025	.80
4026	2.40
4027	1.20
4028	1.20
4029	1.50
4030	1.50
4031	2.95
4032	2.75
4033	2.75
4034	3.50
4035	1.95
4038	3.25
4040	1.90
4041	1.50
4042	1.00
4043	1.60
4044	1.20
4045	4.90
4046	2.50
4047	1.90
4048	1.20
4049	1.00
4050	1.00
4051	1.50
4052	1.50
4053	1.50
4054	3.90
4055	3.90
4056	4.20
4060	2.50
4063	2.00
4066	2.50
4067	9.90
4068	1.00
4069	1.00
4070	.90
4071	.80
4072	.90
4073	.90
4075	.90
4076	1.50
4077	.80
4078	.80
4081	.80
4082	.80
4085	2.20
4086	2.30
4089	3.50
4093	.75
4094	3.35
4095	2.40
4096	2.40
4097	6.50
4098	2.90
4099	3.90
4104	6.90
4160	1.25
4161	1.25
4162	1.25
4163	1.25
4174	1.25
4175	1.60
4194	1.95
4402	1.00
4404	1.15
4408	6.90
4409	13.50
4410	11.50
4411	12.60
4412	5.45
4415	10.15
4416	5.60
4419	3.45
4422	9.50
4426	2.35
4428	1.75
4433	2.75
MC14433	13.90
4435	7.95
4441	1.50
4443	3.90
4445	2.65
4446	3.55
4449	1.00
4450	3.75
4451	3.75
4457	5.90
4458	9.90
4469	14.90
4490	5.90
4495	3.95
4500	8.90
4501	.50
4502	1.80
4503	.90
4504	2.00
4506	.75
4507	.40
4508	4.50
4510	1.50
4511	1.50
4512	1.10
4513	2.65
4514	2.90
4515	2.90
4516	1.45
4517	8.75
4518	2.50
4519	1.90
4520	2.55
4521	3.90
4522	1.90
4526	1.85
4527	2.65
4528	1.15
4529	1.80
4530	1.60
4531	1.65
4532	2.65
4534	8.90
4536	6.50
4538	3.50
4539	1.65
4541	1.60
4543	2.50
4544	10.50
4549	7.25
4551	1.80
4553	5.50
4554	2.35
4555	1.10
4556	1.25
4557	7.85
4558	2.25
4559	7.25
4560	3.75
4561	1.80
4562	8.45
4566	3.00
4568	4.25
4569	2.50
4572	.75
4580	8.95
4581	3.10
4582	2.25
4583	1.65
4584	.85
4585	2.10
4597	
4599	3.45
45104	7.25
45106	7.85
45107	7.25
45109	7.25
45112	7.85

RESISTOR PACKS

SIPS RESISTORS
PIN 1 COMMON

6 PIN	
R27100	
100 OHM	1.20
R27105	
220 OHM	1.20
R27110	
330 OHM	1.20
R27115	
470 OHM	1.20
R27120	
560 OHM	1.20
R27125	
820 OHM	1.20
R27130	
1K OHM	1.20
R27135	
1K2 OHM	1.20
R27140	
1K5 OHM	1.20
R27145	
1K8 OHM	1.20
R27150	
2K2 OHM	1.20
R27155	
2K7 OHM	1.20
R27160	
3K3 OHM	1.20
R27165	
4K7 OHM	1.20
R27170	
5K6 OHM	1.20
R27175	
6K8 OHM	1.20
R27180	
8K2 OHM	1.20
R27185	
10K OHM	1.20
8 PIN SIPS	
R28100	
100 OHM	1.40
R28105	
220 OHM	1.40
R28110	
330 OHM	
R28115	
470 OHM	
R28120	
560 OHM	
R28125	
820 OHM	
R28130	
1K OHM	
IR28135	
1K2 OHM	
R28140	
1K5 OHM	
R28145	
1K8 OHM	
R28150	
2K2 OHM	
R28155	
2K7 OHM	
R28160	
3K3 OHM	
R28165	
4K7 OHM	
R28170	
5K6 OHM	
R28175	
6K8 OHM	
R28180	
8K2 OHM	
R28185	
10K OHM	
10 PIN SIPS	
R29100	
100 OHM	
R29105	
220 OHM	
R29110	
330 OHM	
R29115	
470 OHM	
R29120	
560 OHM	
R29125	
820 OHM	
R29130	
1K OHM	
R29135	
1K2 OHM	
R29140	
1K5 OHM	
R29145	
1K8 OHM	
R29150	
2K2 OHM	
R29155	
2K7 OHM	
R29160	
3K3 OHM	
R29165	
4K7 OHM	
R29170	
5K6 OHM	
R29175	
6K8 OHM	
R29180	
8K2 OHM	
R29185	
10K OHM	

JUST GIVE US THE NUMBERS



Digital handheld multimeters are now quite common and relatively inexpensive. You can pay between $40 and $300+, depending on features and performance. Pay what you can afford — you'll likely have it for a long time. These two are typical of the variety available. The Univolt DT-845A (from Benelec, Sydney) features a rotary function selection switch and autoranging. The Parameters 7040 on the right features thumb-press (left hand) range and function select switches and comes with a carry case. Both cost under $100.

to gigantic two-handed monstrosities used for cutting fencing wire, sidecutters are used for cutting component leads to length, cutting off excess leads after soldering, cutting hookup wire, etc. They're also good on toenails! Pay good money and get quality. This applies to all your tools. They last longer and work better.

Your sidecutters should have a precise cutting edge around 8-10 mm or so long, flush on one side so that you can get right up against a tag, terminal or printed circuit board. They should fit comfortably in your hand and have a spring return that is not too stiff. The handles should be covered in plastic insulation, mainly for comfort.

When using sidecutters on component 'pigtails' (the stiff wire leads), the part cut off can fly away with some speed and force. Watch it! That's dangerous to eyes. Use the sidecutters so that the dross flies toward the bench or floor. Some brands of sidecutters feature an attachment that prevents the cut bits flying off.

You'll need two types of pliers. One snub-nosed set with 'toothed' jaws. They should have jaws around 15-20 mm long. They're for gripping things, particularly component leads and nuts. As for the sidecutters, get a pair with insulated handles that fit comfortably in your hand and have a spring return that isn't too stiff.

You'll need a pair of flat long-nosed pliers, too. They're very useful for holding things in awkward places — and when you can't find the other pair! They should have jaws from, say, 40 mm to 80 mm long; with insulated handles, of course. Spring return is not necessary.

In screwdrivers, you'll need two types: flat-blade and Philips-head. In each, you'll need a 'medium' (5-6 mm shaft) and a 'small' (3-4 mm shaft). If you want to go "the whole hog", a set of 'precision' screwdrivers can be handy.

Many people consider "nut drivers" or 'Spintates" to be superfluous, but we consider them to be almost *indispensible*. Just two will carry you through most jobs: a 5 BA (6 mm across the flats) and an 8 BA (4.25 mm across the flats).

Along with nut drivers, too many people, foolishly, consider a "wire-stripping" tool superfluous. Nothing could be further from the truth. Sure, you can *get by* without one, but you shouldn't on a regular basis. There are *lots* around. All we can advise is: *try before you buy*. Then buy something with which you feel comfortable.

The sort of *drilling* mostly required with electronic construction calls for a small diameter, high speed drill. Printed circuit boards, in particular, require small diameter holes and they need to be drilled at high speed — typically 5000-10 000 rpm. There are a number of small, hand-held drills on the market which will do the job admirably. Some are battery operated, some are run from a mains plugpack or power supply. Most component holes are drilled to either 0.8 or 1.0 mm diameter. However, a drill set ranging from 0.5 mm to 6.5 mm is very useful. Common sizes used for mounting mechanical components are 7 mm to 10 mm. For drills of this size, you'll need a conventional hand or electric drill.

For shaping, finishing or enlarging holes, a set of small files comes in handy. "Needle" files are generally useful for electronics work. What to get? Well, you should get one 'flat', one 'half-round', one 'rat-tail' and one 'triangular'.

Not essential, but useful, is a "jeweller's saw" or small jigsaw. With this you can cut small holes of varying shapes in thin metal or plastic (panels, for example) or printed circuit boards.

Some form of 'hobby' cutting knife (such as an "NT-cutter") is also useful. There's no need to suggest the myriad uses here, get one and it will find uses for itself!

That pretty well completes the mechanical aspects of the toolkit. You could, of course, fit out your 'workshop' with a drill press, lathe, vyse, grinder etc. But you're just starting out, remember?

THE ULTIMATE TEST INSTRUMENT?

An oscilloscope makes an extremely versatile test instrument. You can view waveforms, measure voltages, periods and frequency with one. Serious hobbyists eventually get one. This BWD oscilloscope is Australian made.

'Test' tools

With all the kit and kaboodle described before, you can put a project together, and it *might* work straight off. But the nature of human beings, and electronics, is such that it *might not,* too!

What you need at this stage, to 'trouble-shoot' or check the workings of a circuit, is a *multimeter.*

A multimeter is a tool that will measure all the basic electrical parameters of a circuit, component or whatever. In its basic form, a multimeter will measure *voltage, current* and *resistance.* Most multimeters, however, will have some added "feature" (intended to get you to buy that model, rather than the opposition's). Such features might include a transistor 'tester', capacitance measurement, etc.

With multimeters, in general, you 'gets what you pays for'. But that shouldn't stop you shopping around.

The first parameter to take into account when buying a multimeter, is *sensitivity.* This is expressed as 'so many ohms per volt'. Don't try to work that out just now. As a minimum, get a multimeter with a *basic* sensitivity of 20 000 ("20 k") ohms per volt. A sensitivity of 100 000 (100k) ohms per volt would be better.

There are two types of multimeter to choose from: *analogue* and *digital.* Analogue meters are generally the cheaper variety and have a 'needle' movement that moves over a scale. They're simple and the technology is as 'old as the hills'. You can pay anything from around $8 to $150 or so. The majority are designed for operating on a bench or in the hand. At the bottom end, they have 10 ranges or so. At the top end, they might have over 30 ranges.

In digital multimeters, there's a positively *huge* choice. For beginners, accuracy is not all that important. You can pay anything from about $45 for a four-function, 3½-digit autoranging type to around $300 for a top-line model. When deciding to buy, pick the features you feel are necessary to your interests, or pick something in the low-price bracket that offers value for money.

With multimeters, your first one won't be your last, by any measure, so plan on replacing it at some future date. Value for money is what you're looking for. We'll go into this in more depth later in the series.

There are plenty of other test instruments you can use, but the multimeter is probably the *basic* one you'll *always* have. As you progress, you can get *logic probes,* or an *oscilloscope* to show you waveforms, *signal* and *function generators* to produce test signals, etc, etc. The best way to go about it is: get them as you need them. Often, you can build your own test instruments for a fraction of the cost of ready-made commercial types. Sounds like a good basis for a simple project series!

Don't hang about — get started! ●

PROJECTS TO BUILD!

That's what the hobby is all about: Practical projects, fun projects. Build your own test instruments, hi-fi gear, battery chargers, metal detectors, 'toys', etc. Here's a sample of simple hobbyist projects we've published over the years. Once you get a bit of experience, you can tackle things as complex as a computer, complete stereo hi-fi amplifier, signal generator, etc.

Why pay thousands for security?

It's so easy with these superb security system components from Dick Smith Electronics. Everything from the very latest in integrated circuit control units right through to the sensors you use to stop thieves **before** they get in!

Don't know what to do? No worries: our exclusive booklet 'How to install your own burglar alarm' will tell you how easy it is! Yes, YOU can put in your own fully professional quality alarm system at a tiny fraction of the cost of professional installation.

Top quality Swiss made infra-red people sensor

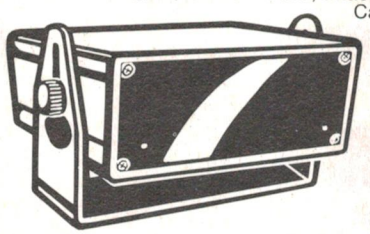
The very latest: Swiss made quality detector actually senses human radiation — even from across a room! Virtually no false triggering, ultra reliable. Simple connection to our Security Centre (L-5100) and Bookshelf Control Module (L-5102).
Cat L-5010

Two other models also available.

ONLY **$119**

Microwave Sensor

Want to catch them in the act? Silent, invisible microwaves detect any movement in the target area and trigger the alarm device. 12V operated. Range up to 15 metres, attaches to any alarm system!
Cat L-5000



Latest technology!

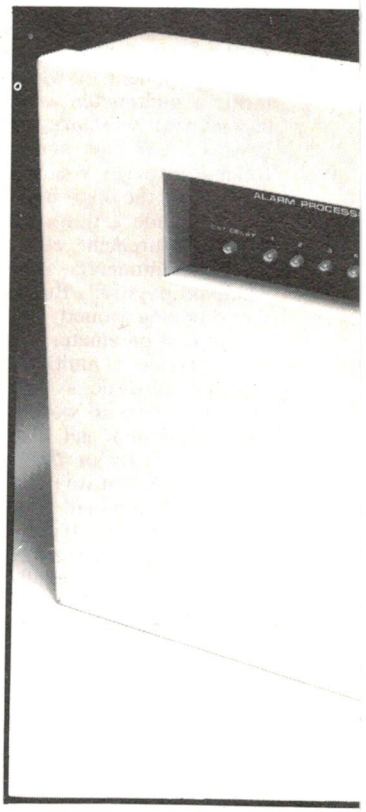
$95

Professional Quality Security Centre

This is it! The most professional alarm system we've ever seen – and it's suitable for homes, offices, factories . . . you name it! With six individual sectors all full controllable for instant or delayed alarm, each able to isolate and each triggerable by a huge range of sensors: the type of alarm used by banks, etc where security is paramount.

Imagine how it would protect your home!

The type of alarm system the professionals charge $1000 or more to install!



Ultrasonic Blaster!

The 'Claytons' alarm: the ideal alarm for those who don't want to put in alarms! This one is fully self contained, including siren speaker. Just place it on the shelf and its invisible ultrasonic rays detect movement. Fantastic for single room protection; can also be used as a sensor on a master alarm console. Includes sensitivity control, operates from external 12V battery, from mains via optional plug-pack with internal battery back-up. Has provision for external speaker, sensors, etc.

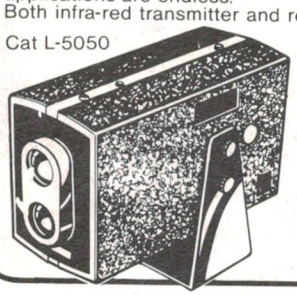
$99

Cat L-5108

Infra-red Beam

Burglar Alarms ... Door Minders ... People Counters ... the applications are endless!
Both infra-red transmitter and receiver are in the same unit, with a reflector supplied to send the beam back. A sensitivity control allows 'fine tuning' to suit the location. Mains (240V) powered, with a 12V DC @ 1A output each time the beam is broken. The unit can be set for two modes: 'instant' (output while beam is broken) and 'intermittent' (outputs for five seconds after beam is broken).

Cat L-5050



ONLY **$99**

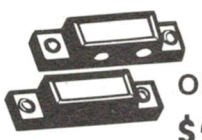
Magnetic Switches

100% Hidden Magnetic (Reed) Door & Window Switches. What a great idea! Ideal for all alarm systems — usable in wood, aluminium & other doors/windows. They are covered by window/door when closed — no one knows they're there! Operates between 8 & 10mm.

Cat L-5212

ONLY **$3.95**

Reed Switch/Magnet Set. Mounted so the magnet holds the switch closed, if the door is opened, switch opens. Attaches to most alarm systems.



ONLY **$2.75**

Cat L-5210

Plus! Everything you need for no-fuss installation of your alarm system . . . such as

Wire

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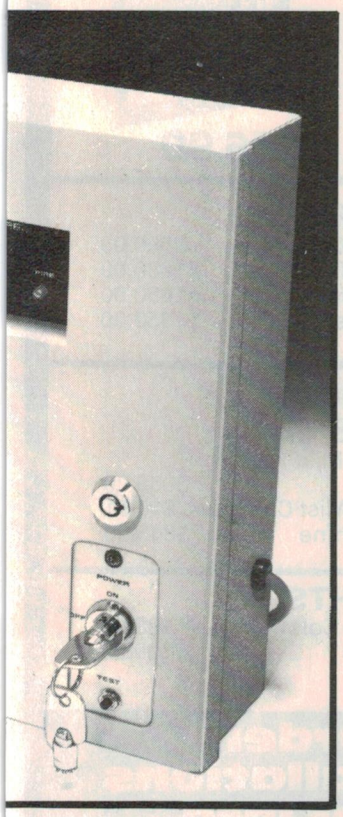

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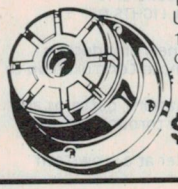

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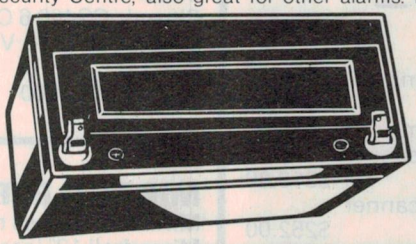

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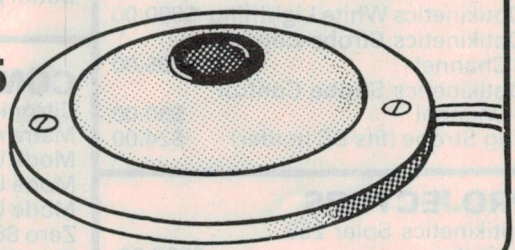

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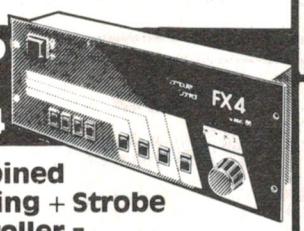

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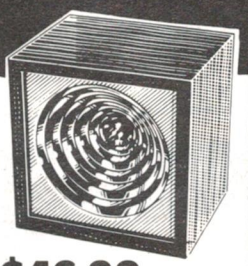

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New technology for TVs

The first digital TV, recently released on the market in Japan, was manufactured by National Panasonic's parent company, Matsushita Electric Industrial Co. It is claimed that the digital video circuitry will provide crisper images, expanded capabilities and cost less to make.

Current analogue TV sets generate pictures by processing analogue signals which are sent out by TV stations. Matsushita's digital TV converts these analogue video signals into digital signals, giving a claimed cleaner image due to reduction of spots, screen flickering and colour saturation.

The digital circuitry was developed by a division of ITT in West Germany, combined with Matsushita-originated peripherals and memories to provide 'window' monitoring displays inset on the normal picture.

The monitor mode provides two pictures, one at full-screen size and the other a 150 mm insert. The smaller picture is produced with analogue signals from a VCR, video disc player or video camera.

The signals are analysed in units of 96 x 128 picture elements, and each pixel is converted to a digital code. By this process, each picture frame is stored in the 64K semiconductor memory and a memory-control LSI synthesises the picture frames with the full-screen display. The smaller 'window' image can be erased and moved around on the screen.

This multifunction digital TV can easily incorporate a tuner and adaptor for videotext and Teletext and will hookup directly with home computers, stereos, VCRs and other forms of component TV. It has one 21-pin and one eight-pin RGB input terminals and three video input terminals, and switching for combining TV or prerecorded video from video cassette or video disc players. The picture tube has a 0.55 mm mask pitch for high-resolution display of text.

It has one-touch white balance and full remote control which can be used to adjust all functions and changes in picture contrast and brightness, tint and colour. The remote control unit currently controls 61 functions, including various functions of any VCR, video disc player, personal computer or video camera.

Although the set performs many complex image-manipulation and enhancement functions, it has about one-fifth the number of components in its video circuitry as an ordinary analogue TV set. It measures 481 × 503 × 518 mm and weighs 27.5 kg. Sound output through the multiplex audio system is 5 W per channel, through two 120 mm diameter speakers.

Hitachi is also planning to release a new TV soon. The 480 mm TV includes ghost-chasing circuitry that reduces the presence of secondary images that result in interference and overlapping signals.

Hitachi conducted a survey in Japan which showed that about 78% of home TV reception is haunted by ghosts that appear as shadow images 5-150 mm to the right of the regular image. Compensating circuitry reduces the video signal-to-noise ratio by 14-20 dB, which reduces the ghost image to between one-fifth and one-tenth of its original intensity, depending on the strength of the interfering signal.

Hitachi has filed 56 patent applications for the two-stage, CCD (charge coupled device), transverse filter method that it uses to wipe out the ghosts with digital conversion of misaligned signals. The circuit kicks in within 10 seconds after the channel is changed with the electronic tuner.

JVC stereo video

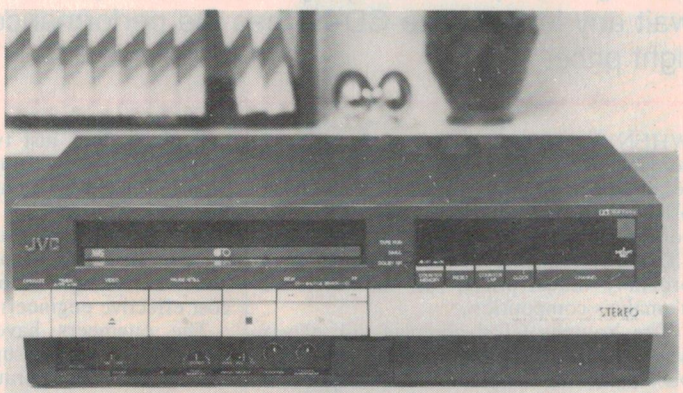
The Japanese manufacturer, JVC, has just announced the release of its latest video recorder the HR D225.

The stereo facility, with its Dolby B noise reduction circuitry, can record FM radio/TV simulcasts or give full stereo sound to your favourite video tapes.

A high-speed visual search system, Shuttle Search, plays the tape at nine times normal speed in either direction, making it quick and easy to locate any desired programme segment. Still frame and frame advance facilities are also built in.

There is a special picture sharpness control, which can vary the video image to he degree of sharpness most pleasing to your eye. The HR D225 has presetting facilities for 16 broadcast channels, and a new up/down facility for channel scanning.

The unit has an instant recording facility which double as a sleep timer for automatic shut-off of recordings, and a 14 day/8 event program timer which offers almost limitless viewing flexibility.



AM stereo — still a debacle

Radio i, in Auckland New Zealand, claims to be the first station outside North America to broadcast in AM stereo, having introduced transmissions earlier this year.

The Harris system is used for the broadcasts of 1X1 Auckland on 1332 kHz. Radio i commenced operation in 1969 as a private commercial station. It features an 'easy listening' format, often giving it top ratings in Auckland in competition with Radio New Zealand 1ZB.

The station's Managing Director, Mr Graeme Edwin, said that five special listening posts had been established in stores around Auckland to give the public the chance to hear the station in stereo. Radio i has imported Sony receivers for this purpose.

Although receivers are not widely available in NZ yet Radio i has taken this pioneering step because the station has no doubt that AM stereo will be the sound of the future.

In Australia, 12 stations have been carrying out tests in AM stereo. Unfortunately four incompatible systems are being tested by different stations. 2CH Sydney is testing with the Kahn system, while other stations are using either Motorola, Magnavox or Harris. One receiver being marketed is capable of tuning to any of the four stereo systems.

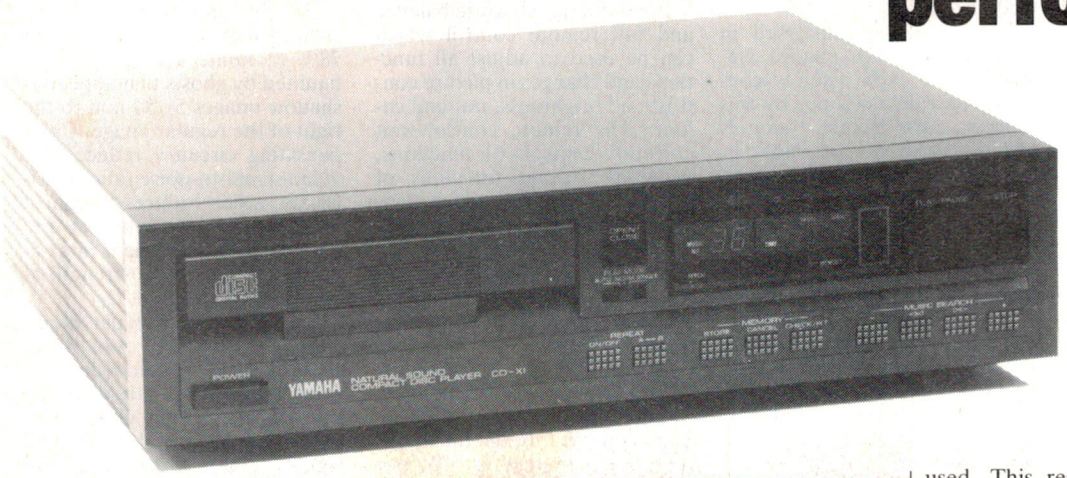
The Australian Department of Communications has approved experimental transmissions for all four systems. The New Zealand Post Office has approved the Harris system in New Zealand.

Present radio receivers cannot be economically modified to accept AM stereo, but the introduction of any new system will not affect the old receivers.

— Arthur Cushen

YAMAHA CD-X1

Topline performance Holden price!



If you've been waiting for the price of CD players to drop, or waiting for superior CD players to arrive, you don't have to wait any longer. The CD-X1 has the performance, and at the right price.

WHEN YAMAHA released the CD-X1 compact disc player with a recommended retail price of almost one- third of their original CD-1 model, they really set their competition a merry chase. Although the CD-1 was over-priced, the CD-X1 is most probably under-priced in the eyes of Yamaha's competition.

The Yamaha CD-1 compact disc player was unquestionably an excellent, but complex piece of equipment. It incorporated double digital circuitry and an array of complex electronic refinements that overwhelmed many intending purchasers. The sales were slow. So the design team started developing a unit which would offer as good a performance as the CD-1, with a price that could not be resisted.

The secret of the CD-X1 is basically a metamorphosis of the bulk of the original electronic circuitry in the CD-1 compact disc player into just two large scale integrated circuits which are electronic 'works of art'. One LSI circuit has 64 pins and the other has 40 pins. The metamophosis also extended into the mechanical design as the case has become a complex but beautiful example of plastic moulding and cost effective engineering design.

The engineers have completely redesigned the laser pick-up system into a new three-beam configuration which is less than half the size of the original unit. It has markedly superior tracking capabilities to almost any other CD player on the market.

The basis of the digital system has been modified so that the digital-to-analogue conversion rate is doubled. The digital filter operates at 88.2 kHz instead of 44.1 kHz so that a simpler filter with smoother and more gentle skirt can be used. This results in an improved phase response and achieves superior results at a lower cost when compared to the original unit.

Features

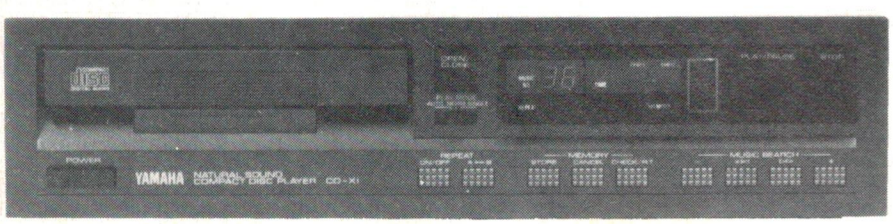
The frontal appearance of the CD-X1 bears a fleeting resemblance to the CD-1, as well as to some of the competitors' compact disc players. Yamaha also believe that 'black is beautiful' and the CD-X1 makes a feature of black buttons and white lettering to achieve an extremely neat and functional appearance.

The disc drawer is located on the left-hand side of the main panel and below it is the power 'on/off' switch. When the unit is first switched on without a disc in the drawer, a flashing green light softly illuminates the area below the bottom of the disc drawer. When a disc is loaded the light stops flashing.

In the middle of the panel is an 'open/close' button which must be pressed to open the drawer but is not essential to close the drawer. Unlike some of the competitors' units, you can push on the front of the drawer and it will close without trauma; or you can press the 'play' button and the drawer will automatically close and the disc start to play. Below the

YAMAHA CD-X1 COMPACT DISC PLAYER

Dimensions:	*340 mm wide x 92 mm high x 290 mm deep.*
Weight:	*3.6 kg*
	Price: Rrp $599.
Manufacturer:	*Yamaha Nippon Gakki Cox Ltd, Hamamatsu, Japan.*
Distributor:	*Rose Music, 28 Kent St, Belmore NSW 2142. (02)750-8999.*



Simple design. The front panel features clean lines and simple layout of the controls and displays.

'open/close' button is a 'play mode' switch which selects three functions: 'auto', 'normal' and 'single'.

In the 'auto' mode playing will commence as soon as the power is switched on (if a disc is already in the drawer) or it will play at the pre- programming time, if an automatic timer is connected. In the 'normal' mode the playback begins when the 'play' button is pressed, while in the 'single' mode the unit will stop playing after each individual track and then has to be restarted with the 'play' button.

On the right-hand side of the front is a large 'play/pause' button which sensibly provides both functions. On the extreme right-hand side of the panel is the 'stop' button whose function is self-explanatory. In the middle of the panel is a small, clear, plastic escutcheon. Behind it the music number is indicated on the left-hand side; the elapsed time of the selection being played, or the remaining time of the disc is on the right-hand side.

The music number display, unlike some of the other units on the market, works all the way up to '99', which is fortunate as many of my latest CD test discs contain 99 tracks. The escutcheon also contains four illuminated displays which indicate which choice of a possible series of functions has been selected. These are 'repeat', 'A-B repeat', 'memory' and 'play' modes.

On the bottom of the front panel are nine buttons which provide a wide range of controls. The designers claim that these buttons are so simple that they virtually explain themselves.

My staff and I do not support that view as two of my staff tried to use the controls without reference to the handbook and found that they ended up with somewhat different results to what they had expected. I believe that the days of picking up a piece of equipment and being able to use it correctly without reference to the handbook are long gone.

The first of these controls is the 'on/off' repeat button which allows you to either replay the whole disc, or just those sections that have been programmed into the memory using the three memory control buttons. The second 'repeat' switch is labelled 'A-B' and is pressed once at the start of the section whose cyclical playback is required (during the normal replay cycle) and pressed again at the end of that sequence. The programme section between the two specified points automatically replays 'over and over again'; as long as you so desire, until you've had enough.

This particular feature has unquestioned benefits for the technical reviewer who can select a portion of a test disc and replay it through his analysis equipment, without the problems that are common with a record player. Its uses for other purposes is far less obvious, although it will no doubt prove to be an excellent conversation piece. ▶

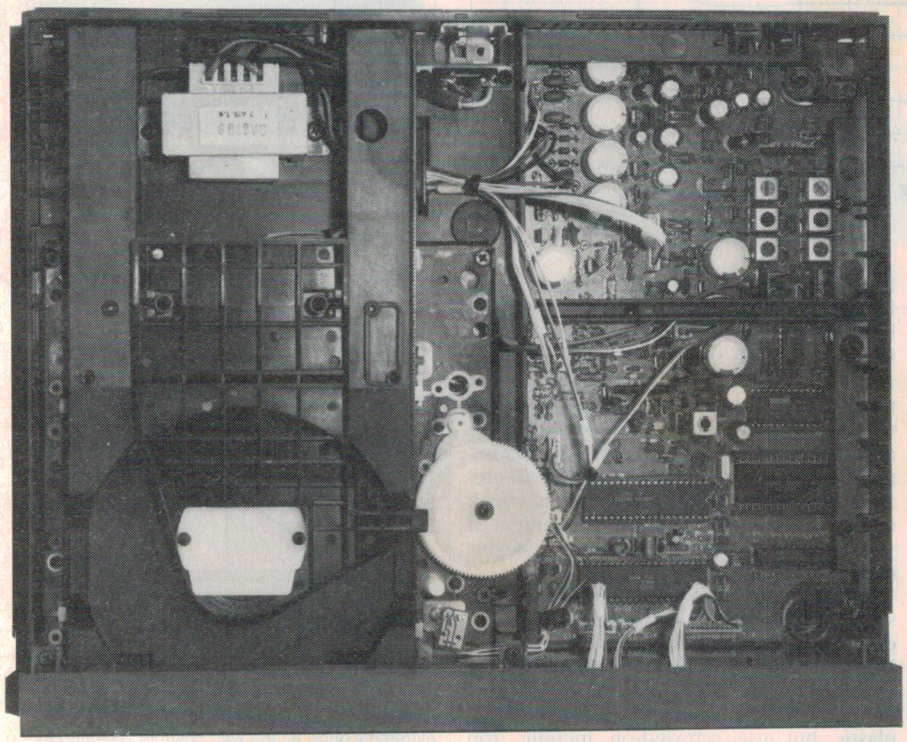
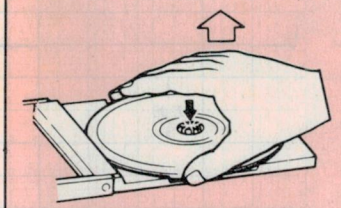


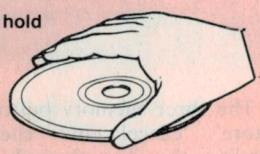
Figure 1.
Engineering masterpiece — in plastic! The disc drawer and transport are constructed of ingeniously designed plastic components, as is most of the cabinet. The single printed circuit board containing all the electronics is at right. Note the LSI chips at the front.

HANDLING COMPACT DISCS

- Always place the compact disc in the disc tray with the label facing upward (Compact discs can be played only on one side.)
- To remove a disc from its storage case, press down on the centre of the case and lift the disc out, holding it carefully by the edges.



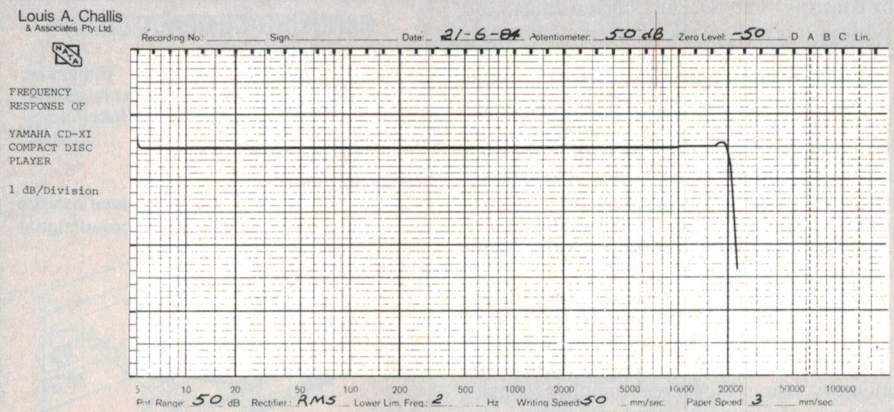
Proper way to hold compact disc

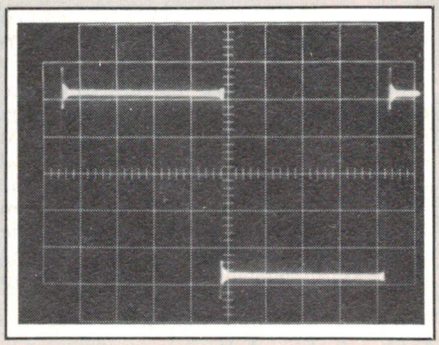


- Fingermarks and dust should be carefully wiped off the disc's recorded surface with a soft cloth. Unlike conventional records, the compact disc has no grooves to collect dust and microscopic debris so gently wiping with a soft cloth should remove most particles. Wipe in a straight motion from the inside to the outside of the disc. Small dust particles and light stains will have absolutely no effect on reproduction quality.

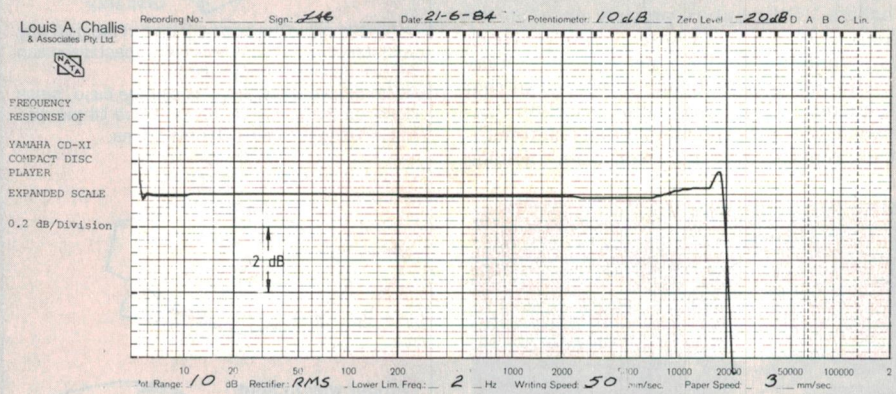
- Never use such chemicals as record sprays, antistatic sprays or fluid, benzine or thinner to clean compact discs. Such chemicals would irreparably damage the disc's plastic surface.
- Discs should be returned to their cases after use to avoid serious scratches that could cause the laser pickup to "skip".
- Don't expose discs to direct sunlight or high humidity and temperature for extended periods. Long exposure to high temperatures can warp the disc.
- Don't stick paper or don't write anything with ballpoint pen on the surface of the label side.

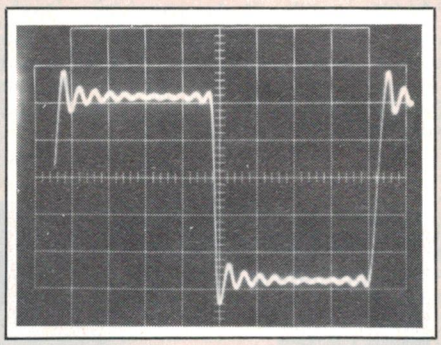
(Material courtesy Yamaha)





100 Hz





1 kHz

The three memory buttons are labelled 'store', 'cancel' and 'check/RT'. When playing the disc through in the 'music search' mode, looking for a specific selection for which a subsequent memory cycle is desired, one presses the memory 'store' button. On moving further forwards or backwards through the disc one repeats this function in order to store the required sequence in the memory.

By using these two switches, together with the forward and backward music search switches, one does have a more tedious and less direct control facility than that provided by CD players with a numeric key pad. What you are getting, however, is the same function without the complexity, the size or the cost of the competing units.

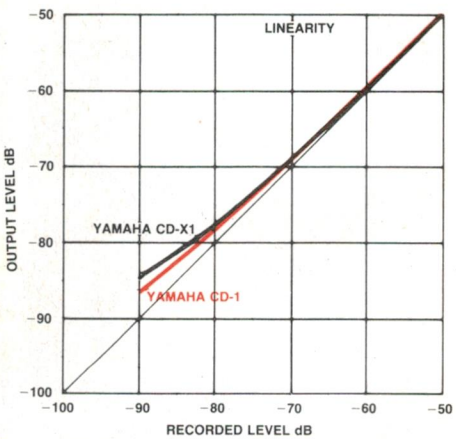
The third memory switched labelled 'check/RT' can be used in two different ways. If you press the 'stop' button and press 'check/RT' sequentially, it will display each of the tracks selected, together with the appropriate total recording time of that track and the remaining programmed track times. If the 'check/RT' switch is held down during playback it will at first display the same information and, after three seconds, the elapsed time on the track actually being played.

The four music search buttons are labelled '—', '◁◁', '▷▷' and '+'. They allow you to index forwards or backwards, by individual track numbers, using the ± buttons and fast-forward and fast-reverse buttons. The fast-forward and fast-reverse buttons operate slowly for the first three seconds, and then engage in a high speed mode which simultaneously reduces the unit's playback volume to protect your amplifer and speakers. During 'pause' these controls increment forward or reverse in one minute intervals of the track content; this is particularly convenient if you know where a section of music begins or ends.

The rear of the player is particularly sparse with a pair of coaxial sockets and a double insulated mains lead which has been sensibly designed for only 220/240 volts operation. The front, sides and rear of the cabinet is fabricated from moulded plastic but use screwed-on metallic top and bottom panels to provide rigidity, strength and access convenience.

The inside of the cabinet using a wide range of different plastics, some metal and many ingeniously designed plastic inserts. The tray mechanism is worthy of special comment as many of its elements look like metal but are, in fact, ingeniously designed pieces of plastic.

The circuitry uses only two printed circuit boards which are particularly small. These use a phenolic material but are, nonetheless, executed to a high standard. The underside of the boards is fully protected by masking over the laminate. Even though they are simply constructed, their operation is complex.



By comparison. The linearity of the CD-X1 is ". . . extremely good all the way down to −60 dB where it is better than the CD-1 (reviewed Sept. '83), but is slightly inferior over the −80 dB to −90 dB range".

The electronic circuitry on the main pc board (see Figure 1) consists of integrated (LSI) circuits which have replaced literally dozens of other integrated circuits, transistors, diodes and components. This has resulted in a printed circuit board that looks only slightly more complex than a transistor radio.

MEASURED PERFORMANCE OF YAMAHA CD-X1 SERIAL NO. 26867

DISTORTION

AT MAXIMUM OUTPUT LEVEL = 0 dB

	100 Hz	1 kHz	10 kHz	
2ND	-106.2	-114.3	-85.6	dB
3RD	- 88.5	-105.7	--	dB
4TH	-107.3	-107.9	--	dB
5TH	-105.2	-106.2	--	dB
T.H.D.	- 88.3	-101.5	--	dB
	0.0038	0.00084	0.0052	%

AT INDICATED LEVELS FREQUENCY = 1 kHz

LEVEL	-10dB	-20dB	-40dB	-60dB	-80dB	
2ND	- 84.5	-101.1	-84.2	-57.9	-27.5	dB
3RD	- 90.4	- 88.4	-72.4	-43.3	-21.9	dB
4TH	- 97.4	-104.9	-82.1	-57.5	-28.5	dB
5TH	-110.7	- 92.0	-72.3	-42.4	-40.6	dB
T.H.D.	- 83.3	- 86.6	-68.9	-39.7	-20.1	dB
	0.007	0.0047	0.036	1.04	9.9	%

EMPHASIS

FREQUENCY	RECORDED LEVEL	OUTPUT LEVEL (LEFT)		OUTPUT LEVEL (RIGHT)	
1 kHz	-0.37 dB	-0.2	dB	-0.2	dB
5 kHz	-4.53 dB	-4.4	dB	-4.3	dB
16 kHz	-9.04 dB	-9.9	dB	-9.5	dB

COMPACT DISC PLAYER DATA SHEET

MEASURED PERFORMANCE OF YAMAHA CD-X1 SERIAL NO. 26867

FREQUENCY RESPONSE

FREQUENCY	OUTPUT LEVEL dB V
1.0 kHz	+ 6.5
20 Hz	+ 6.6
40 Hz	+ 6.6
100 Hz	+ 6.6
200 Hz	+ 6.6
500 Hz	+ 6.5
1.0 kHz	+ 6.5
5.0 kHz	+ 6.4
7.0 kHz	+ 6.3
10.0 kHz	+ 6.3
16.0 kHz	+ 6.0
18.0 kHz	+ 6.3
20.0 kHz	+ 5.9

LINEARITY

RECORDED LEVEL dB	OUTPUT LEVEL dB
0.0	0.0
-1.0	-1.0
-3.0	-3.0
-6.0	-6.0
-10.0	-10.0
-20.0	-20.0
-30.0	-30.0
-40.0	-40.0
-50.0	-49.9
-60.0	-59.8
-70.0	-69.3
-80.0	-78.0
-90.0	-84.7

SIGNAL TO NOISE RATIO

WITHOUT EMPHASIS	93.4 dB (Lin) 99.1 dB(A)
WITH EMPHASIS	94.0 dB (Lin) 101.5 dB(A)

CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100 Hz	-95.1	-94.9
1 kHz	-84.4	-84.0
10 kHz	-64.2	-65.0
20 kHz	-57.0	-58.9

Objective testing

The objective testing of this unit proved to be even more simple than when we reviewed the CD-1 (almost one year ago). The frequency response is extremely flat, as both the normal level recording and the expanded scale level recordings show. The unit exhibits a miniscule 0.6 dB, rise between 18 kHz and 20 kHz, but is virtually ruler-flat everwhere else.

The digital-to-analogue output conversion linearity is extremely good all the way down to −60 dB where it is better than the CD-1, but is slightly inferior over the −80 dB to −90 dB range.

The signal-to-noise ratio without emphasis is almost identical to the CD-1, but is inferior with emphasis at 94 dB unweighted and 101.5 dB A-weighted. The channel separations of the CD-X1 is 5.5-6 dB lower than claimed by the manufacturer at 1 kHz and not nearly as good as that provided by the CD-1. Before you get disturbed, however, it should be pointed out that these levels of separation are still so much better than required that it does not really constitute a loss of effective performance.

The distortion figures of the CD-X1 at 0 VU are much better than claimed by the manufacturer, and also much better than achieved by the CD-1. I have compared the individual harmonic distortion figures against those of the CD-X1 and these reveal that the CD-X1 is superior at each of the test levels, with the exception of −10 dB, all the way down to −80 dB. Even the differences at −10 dB are inconsequential, so I am satisfied that the large scale integrated circuitry has achieved the two most important functions that the designers set out to provide.

It has one other attribute that most other CD players can't match. It can track all of our eccentric test discs at first go, including the nasty one with ±1 mm eccentricity. All of the other objective testing confirms that the basic performance parameters of the CD-X1 are on a par with any other CD player on the market, irrespective of its price.

Subjective testing

The subjective testing of this unit revealed that the functional controls, although deliberately simple, achieve a degree of functional simplicity which I am sure you would appreciate as much as I did. This unit has not been designed for a computer fadist, for whom numeric key pads are stock-in-trade. It has been designed for someone who just wants to play music.

Although I have now tested more than 15 CD players, I found that I did not miss the more advanced control functions that are on many of the other players. I could achieve almost as much without any noticeably greater effort (except with discs containing 99 tracks).

When I received this player I was given two Denon PCM digitally recorded discs from Japan. These typify the best in the new generation of digitally recorded compact discs; the quality has not been compromised by either using old analogue recordings (some companies are doing this), or sloppy recording techniques or inadequate studios, which can be clearly discerned in many of the latest discs.

The subjective testing was done using a disc of Jean Jacques Kantorow performing J. S. Bach's Violin Concerto in D Minor (38c37-7096). It is a brilliant rendition of violin music at its absolute best and it left a spellbinding impression.

This was eclipsed by Jacques Rouvier's piano rendition of Debussy's "Preludes", a masterful rendition of an absolutely lyrical piece of music.

The CD-X1 produced music which was superb, highlighting the excellence of its design. It convinced me that the CD-X1 is a true second generation CD player in the fullest sense of the words. It also convinced me that it is essential to select your CD discs from what I would describe as second generation software, in order to obtain the full benefits of the medium.

If you have been waiting for the price of CD players to drop or for superior CD players to arrive, I suggest your wait is over. The CD-X1 provides the performance and offers it at the right price. ●

CACOPHONY SALE!!

MASSIVE SCOOP PURCHASE
HUNDREDS OF APPLICATIONS
FROM ONLY 75¢!!!!

Jaycar has bought the entire surplus stock of a coaxially mounted electric bell - as used in the Telecom 'Gondola' telephone! This unique bell is actually TWO bells - one mounted coaxially inside the other. The striker is mounted between the rims of the bells and is electromechanically driven. The unit runs on AC from about 17-48V.
The exciting part, however, is the price!! We purchased the bells FAR BELOW MANUFACTURERS COST - so **YOU REAP THE BENEFIT!!**
Cat. LA-5270

START YOUR OWN CACOPHONY!!
1-9 $1.50 ea: 10-24 $1.25 ea:
25-99 $1.00 ea: 100+ 75¢ ea

SMOKE DETECTORS BACK!!

BARGAIN OF THE CENTURY

Once again we have made a scoop purchase of ionisation chamber type smoke detectors.
When we had this product before we sold many thousands at our ridiculously low prices. We sold out of course but NOW THEY'RE BACK!!
The smoke detector is completely self-contained, is round and measures a compact 115mm diameter and 40mm deep. Fixing screws and masonry plugs are provided along with 9V battery and very comprehensive instruction manual.
The "Smoke Sentry" once sold for **$49** and frankly was a flop at that price. Despite the fact that every home should have at least one, people considered that their children and their own lives were not worth that amount.
But now you have NO EXCUSE! Once again Jaycar has made a MASSIVE SCOOP PURCHASE of SMOKE DETECTORS below importers COST! We pass the savings on to you!
If you missed out before HURRY this time. Don't be disappointed!!
Cat. LA-5090

$19.95 1-9 Pcs
10+ **$17.95**

MICROBEE DUST COVER

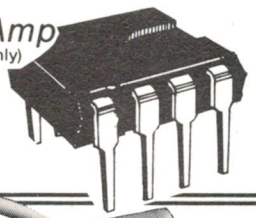
This great new, clear cover will keep dust and grime and all the nasties off your MicroBee. Contacts on the keys will last much longer. Can be removed in a moment. Antistatic treated to repel dust.
Cat. XA-5575 **$9.50**

VOLTAGE REGULATORS

We have had a large demand to expand our range of Voltage Regulators. So here's two new ones in TO-220 flat plastic packs.

7809 Positive 9 volt 1A
Cat. ZV-1509 $1.05 ea - 10 up 95¢ ea
7824 Positive 24 volt 1A
Cat. ZV-1524 $1.05 ea - 10 up 95¢ ea

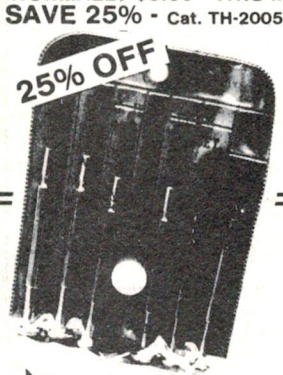
LM 1458N IC
Dual Operational Amp
(Specs supplied upon request only)
Cat. ZL-3753



NORMALLY $1.50
AUGUST ONLY 50¢
10 or more 45¢ each

JEWELLER'S SCREWDRIVER SET BARGAIN!

A vinyl case containing 6 pieces of high quality plated Jewellers screwdrivers. AN ABSOLUTE MUST in every workshop.
GRAB ONE IN MAY AT A BARGAIN PRICE!
NORMALLY $3.95 - THIS MONTH $2.95
SAVE 25% - Cat. TH-2005



$5.95 - SAVE $2.55

We have made a massive scoop purchase of this popular item. **Normally $8.50 each**

ONLY $8.95

"JET PHONE" ADAPTOR - NEW

- IDEAL FOR AIR TRAVELLERS!!

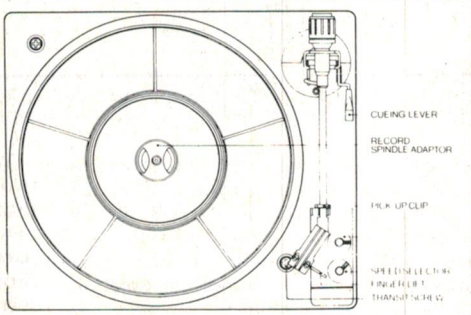
How many times do you travel by air? If you are a regular traveller in economy, you will be undoubtedly familiar with the plastic 'pneumatic' type of stereo headphones. Well, we think that they are hopeless!!
They are uncomfortable (in our opinion) and unless you get a good fit, the sound quality is poor. Wouldn't it be nice to be able to use your OWN high quality headphones in flight?

NOW YOU CAN!!

The Jaycar AA-2040 JET PHONE ADAPTOR plugs into the two air sockets on the armrest. You then plug your headphones into the adaptor for comfortable Hi Fi sound!!

BRILLIANT AND INEXPENSIVE!!

MASSIVE PRICE BREAKTHROUGH!



Jaycar has made a sensational purchase of **Belt Drive Turntables - BELOW** Manufacturers Cost!! Because of our buy we can pass them on to you at a **MASSIVE SAVING.**
The Turntables are made in England by B.S.R. They are unmounted and suitable for Disco Consoles, 3-in-1's etc. They are also ideal as replacements for existing 3-in-1 sets. (See specifications).
But there is an aspect that is **really amazing!** You can work the Turntable from 9-12V DC. This means that you can run the unit from a car or truck!! (The AA0292 model can of course run on 240V mains).
The Turntable features quality Belt Drive operation, lightweight Transcription type arm, Cueing facility and Stereo Ceramic cartridge with Diamond Stylus. The platter has calibration markings to check speed. A simple neon on 240V will "strobe" to the markings). Whilst the 33 & 45 rpm speed has been accurately set in the factory, you have the facility to make pitch adjustments underneath the turntable.
The DC Motor Drive (as used in the best turntables) is electronically controlled!!
Each unit comes with complete instructions.
Quantity limited! You will have to hurry to avoid disappointment.

SPECIFICATIONS:

- ★ Dimensions 330(W) x 285(D) x 60(H)mm overall
- ★ Platter diameter 280mm
- ★ 2 speed - 33 & 45 rpm (internally adjustable)
- ★ Pick-up arm counterbalanced type with cueing facility
- ★ Pick-up ceramic (stereo) with diamond stylus
- ★ Turntable operation - auto stop, will return to rest automatically. Turntable chassis is sprung on all corners with transit screws & clips ★ Weight 1.5kg
- ★ Output stereo RCA sockets underneath unit

ELECTRONIC BELT DRIVE TURNTABLE BSR QUALITY

Check the price! Cat. AA-0290
(Requires 9-12V DC @ 500mA)

ONLY $29.95

240V version - (includes 12V 500mA adaptor)
Cat. AA-0292 **ONLY $39.95**
(Due to the weight of the unit post and packing is $5 NOT $4.50).

Jaycar ELECTRONICS

Incorporating
ELECTRONIC AGENCIES

NUMBER 1 FOR KITS

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117 YORK STREET
Tel: (02) 264 6688 & (02) 267 1614
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Cnr. CARLINGFORD & PENNANT HILLS ROAD
Tel: (02) 872 4444

CONCORD
115-117 PARRAMATTA ROAD
Tel: (02) 745 3077

HURSTVILLE
121 FOREST ROAD
Tel: (02) 570 7000

MAIL ORDERS
& CORRESPONDENCE
P.O. BOX 185
CONCORD, 2137
Tel: (02) 745 3077

JAYCAR - No1 FOR SPEAKERS

SENSATIONAL DEALS ON 3-WAY SPEAKER SYSTEMS!!

A massive scoop purchase of factory distress stock has enabled us to pass on unbelievable prices on quality speaker systems. The component speakers in these systems are normally incorporated into cabinets for many well known national brand HI FI companies.
Each speaker is factory guaranteed for 90 days, however we doubt whether you will ever need to worry about it.

8" 3 WAY SYSTEM

Superb 8" woofer with foam surround suspension and heavy magnet assembly with sealed back midrange and tweeter. System impedance 8 ohms. Power handling 40 watts rms. Crossover capacitors and connecting diagram and recommended 8" cabinet detail drawing supplied.
Cat. CS-2453 (2 required for stereo)

$29.95/set

10" 3 WAY SYSTEM

Once again, a high quality 10" woofer with higher power, sealed back midrange and tweeter. System impedance 8 ohms. In addition a quality Pioneer 3-way crossover is provided at no extra charge. Connection instructions are also provided as well as recommended 10" cabinet plans.
Cat. CS-2454 (2 required for stereo)
INCLUDES PIONEER 3-WAY CROSSOVER!!

$39.95/set

JAYCAR -

WELCOMES YOU TO A WONDERLAND OF ELECTRONICS

6" WIDERANGE

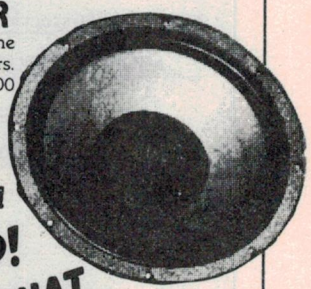
4 ohm impedance. Suitable for cars, or two in a box for extension speaker system. Very high quality curvelinear cone. Normally sells for **$6.95** each. Less than ½ normal cost!
Cat. AS-3011

$2.99 ea
10 up
$2.50 ea

PHILIPS 12" WOOFER

We have made a MASSIVE SCOOP purchase of genuine quality PHILIPS European made 12" HI FI woofers. These are used in the fabulous ETI4000 series kits. 100 watts rms power handling.

CATALOGUE PRICE $99.50
THIS MONTH ONLY $59.50
SAVE A WHOPPING $40.00!!



POST & PACKING CHARGES	
$5 - $9.99	$1.50
$10 - $24.99	$3.20
$25 - $49.99	$4.50
$50 - $99.99	$6.50
$100 - $198	$8.00
Over $199	$10.00

COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY $12.00

SHOP HOURS
CARLINGFORD, CONCORD & HURSTVILLE
Mon - Fri: 9 am - 5.30 pm
Sat: 9 am - 12 pm
Thurs Night: 8.30 pm (Not Concord)
SHOP HOURS SYDNEY
Mon - Fri: 8.30 am - 5.30 pm
Sat: 8.30 am - 12 pm
Thurs Night: 8.30 pm

MAIL ORDER BY

bankcard
VIA YOUR PHONE
MasterCard VISA

8" CEILING GRILLES

Will they ever be this cheap again?

Once again - a massive scoop purchase with a difference. We have purchased a very large quantity of 'reject' grilles. They are rejects because they have small flaws in the mouldings. Most people however cannot pick the flaws if allowed to examine the grille. Imagine what the flaws look like *9 feet up* on the ceiling! Naturally we are offering a massive saving over normal units which we also sell. Exactly the same units (sans flaws) have been sold throughout Australia in the 10's of 000's. The perfect ones sell for around $2.95 - at least one company sells them for well over $3.00.
Cat. AX-3560

P.A. INSTALLERS - GO FOR IT!

SCOOP! WHAT PRICE US?

1-4 UNITS $1.50
5-19 UNITS $1.25
20-49 UNITS $1.15
50 + UNITS 99¢

PRICES INCLUDE TAX

10" ELECTRIC GUITAR SPEAKER

Quality Pioneer brand - check the specs! Check the price!! HURRY

Impedance	8 ohms
Voice Coil dia.	1½"
Power Rating	60W (RMS)
Resonant Frequency	80Hz
Sensitivity	98(dB/W)
Response	80Hz - 7,000Hz
Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 grams

CATALOGUE PRICE $39.95

ONLY $29.95

ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order!If you have one and want one for a friend, that's fine too! Just ask!

8" TWIN-CONE HI FI

20 watts rms with whizzer cone. Air suspension type. Low free air resonance.
Normally this speaker sells for around **$19.95.** The Jaycar massive scoop purchase enables you to buy them this month at only **$9.95.**

AN INCREDIBLE 50% SAVING!!
The stock WON'T LAST AT THIS PRICE - HURRY!!
Cat. CE-2330

NORMALLY $19.95
THIS MONTH $9.95

DENON CD TEST DISC

Louis Challis

This test disc is one of the best bargains of 1984. If you're not planning to buy it then you're obviously not seriously involved with high fidelity as it contains so much invaluable testing information. It gives you the equivalent of more than $10 000 of test equipment for less than $20.

TEST RESULTS

To test a disc like the Denon Audio Technical CD test disc is 'a little hairy'. Our approach was to inter-compare measurements of what are nominally the same signals from four different test discs on two CD players, the Yamaha CD-X1 and the Sony CDP-101. The results of these tests provided measurable and significant differences in performance. Thus, by way of example, the harmonic distortion with the 1 kHz signal on the Sony Type 3 disc provided the following results:

Measured Distortion Performance of Denon Test Disc c.f. Sony Test Disc

AT MAXIMUM OUTPUT LEVEL = 0 dB

	Sony 1000kHz	Denon 1001 Hz	Sony 100 Hz	Denon 100 Hz	
2ND	- 111.4	- 111.5	- 106.2	- 103.0	dB
3RD	- 115.1	- 115.2	- 88.5	- 88.7	dB
4TH	- 107.4	- 107.0	- 107.3	- 106.7	dB
5TH	- 105.9	- 119.0	- 105.2	- 115.6	dB

Louis A. Challis

DENON AUDIO TECHNICAL CD TEST DISC

Disc No: 38C39-7145 (Produced May, 1984).
Price: Rrp $19.95.
Manufacturer: Nippon Columbia and Waseda University for Denon in Japan.
Distributor: TEAC, 115 Whiteman St, Sth Melbourne Vic. (03)699-6000.

TWO YEARS AGO when the first production of Sony CDP-101 players arrived in Australia, I faced a dilemma. Without software you can't test the equipment. Sony produced some magnificent demonstration discs for the initial release of their players, but at that time there was not a single test disc in this country.

We reviewed a CDP-101 a few months later with just two demonstration discs, but we still managed to produce some rather exciting test results in the absence of a definitive test disc.

At that time, Sony in Japan and Philips in Eindhoven made some fairly momentus decisions concerning standards for CD players and for test disc material. Sony produced one disc and Philips a set of three.

The Sony Test Disc Type 3 retails for more than $70 and the Philips disc No. 3 retails for about $100. These discs, like the seven or eight other commercial test discs now available, contain information whose accuracy and precision is far greater than that provided by the average laboratory with test equipment costing tens of thousands of dollars.

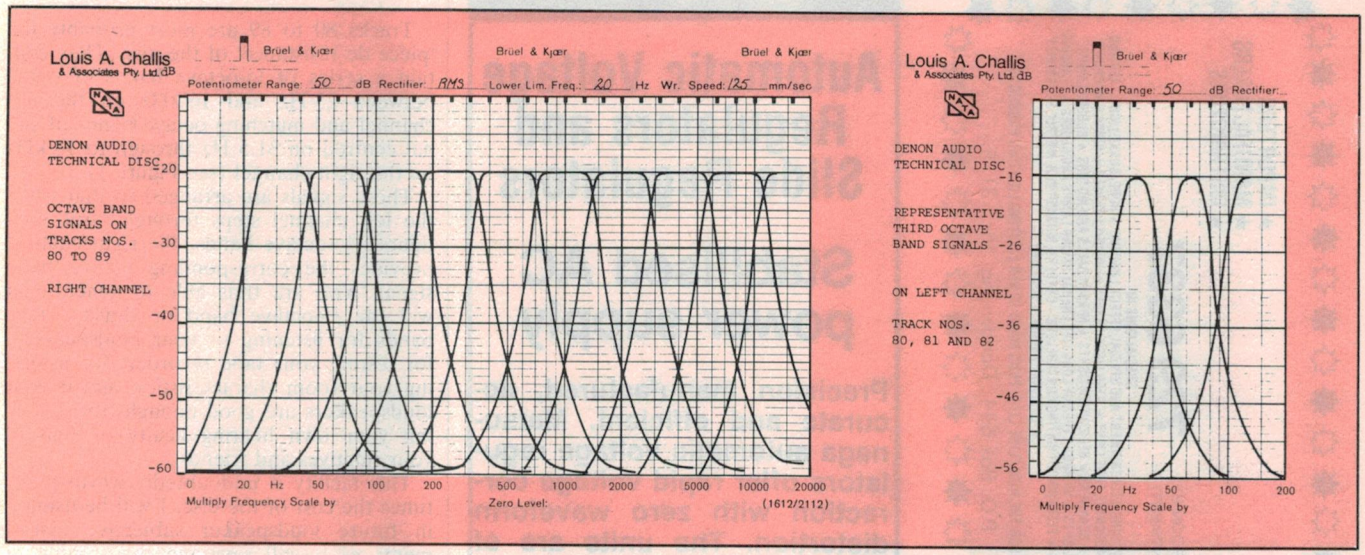
If you own a good CD player then, by purchasing the appropriate CD test discs, you will be able to convert that CD player into a precision piece of laboratory test equipment. You can test not only your CD player but most of your hi-fi equipment, including your tape recorder, amplifier, loudspeakers and even the room in which you do your listening.

This could be, and I venture should be, one of the most exciting pieces of information that you have heard in years. If you are at all serious about your home hi-fi system, then the chances are that you have already spent copious sums of money on ancilliary items of test equipment, probably including test tapes and records. These do not begin to compare with the Denon Audio Technical CD test disc.

I have watched with interest or excitment (depending on the quality of the record) as each new conventional microgroove test record has been released. However, I have been far more interested and concerned with both the availability and content of each new CD test disc, for this medium is not only more demanding, but the availability of appropriate test software is far more important. The reason for this is that no single test disc has contained all the software that I require. Consequently, I have been forced to use six or more laboratory test discs to provide the aggregate information required by a single review (see Yamaha's CD-X1 review).

While my requirements are possibly more demanding than yours, it is equally clear that the average (or above average) hi-fi enthusiast has special requirements in assessing amplifiers, tape recorder, cassette player, speakers and listening room.

In order to perform such testing, it is



clear the test software should be suitable for use by people both with and without supplementary test equipment. The Denon Audio Technical CD test disc provides precisely those facilities *and a whole lot more.*

Features

This particular disc contains almost all the test material that you are likely to require and provides you with the equivalent of more than $10 000 of test equipment for less than $20. Need I say more!!

The Denon test disc contains 99 tracks with a wide range of carefully collected software. Track 1 provides a commentary in English on how to use tracks 1 and 2. This immediately tells you whether your loudspeakers are correctly phased. Just that information alone would be worth the $20 or more that some of my acquaintances have paid servicemen for correctly phasing their speakers, removing 'muddy' sound from their new stereo systems. Tracks 1 and 2 contain in-phase, out-of-phase and channel balancing information, which is particularly well presented.

Tracks 3 to 9 contain a series of orchestral, concerto, chamber music, piano, organ, jazz and rock demonstration material. Tracks 10 and 11 contain announcements in English and Japanese; I was intrigued that this took 108 seconds in English and only 43 seconds in Japanese. Could it be that the Japanese language is twice as efficient as the English language or that we use too many redundant (or long) words? I listened carefully to the Japanese again and discovered that they actually left out some of the text — Shame!!

Tracks 12 to 35 contain test tones at precise frequencies and levels ranging between 0 and −60 dB, as well as 'zero' signals with which the basic background noise of your equipment, or your hearing acuity, may be evaluated. The zero signal level, which the disc describes as 'infinity zero', is an extremely important test which your amplifier and loudspeakers may not necessarily duplicate. It is also interesting to note that the 1 kHz frequency on the test disc is not actually 1 kHz, but 1001 Hz.

The reason for this unusual choice of frequency, like many of the other test frequencies selected on the disc, is that 1001 Hz is a precise sub-multiple of the 44.1 kHz sampling frequency used by CD players. Consequently, it can be digitally derived without the need for separate analogue test equipment. The digital purity of this signal is then absolute, and unwanted inaccuracies are avoided.

Tracks 36 to 39 each contain a 1 kHz reference signal followed by a logarithmically-swept band of test signals covering the range 20 Hz to 20 kHz. Tracks 40 to 45 provide a wide range of intermodulation tests complying with both the International Electro-Technical Commission (IEC) and the SMPTE standards

Tracks 46 to 64 contain a variety of sine wave test signals at 0, −20, −40 and −60 VU including test tones of 40, 100, 315, 1001, 3149, 6301, 9999, 15 999, 17 999 and 19 999 Hz. These are particularly suitable for testing your cassette recorder, tape recorder or loudspeakers, particularly if you can use your VU meters on playback.

Track 65 provides a further logarithmic swept signal covering the range 5 Hz to 22.5 kHz. Tracks 66 to 68 provide three test tones at 100 Hz, 1001 Hz and 9999 Hz which glide from −60 dB to 0 dB per second, to evaluate linearity distortion in your CD player, amplifier, loudspeakers, tape recorder or whatever you may choose to connect to the output of your CD player.

At this point I should stress again a word of warning which the literature gently presents and which I will re-inforce. The test signals that this CD test disc produce cover such a wide dynamic range that the chance of blowing up your amplifier or loudspeakers are particularly good (or bad). It doesn't take much power to destroy a small loudspeaker, particularly when it does not incorporate any internal protection system. Amplifiers are generally a little more difficult to destroy, but they too fail fairly rapidly, particularly if the loudspeaker has already failed. They have to dissipate not only their own power losses, but also the energy that should have been dissipated in the loud speakers.

BE WARNED — CD test discs, as well as being very useful or convenient, are also very much like a loaded gun. If mishandled, or employed in the wrong hands, they can be very dangerous.

Tracks 69 and 70 provide a 401 Hz test signal with the signal phase being rotated through 360° at 12° per second. Tracks 71 to 75 provide excellent square waves and tone bursts at three different frequencies to evaluate your loudspeakers, amplifiers, tape recorder and cassette recorder. These have precise zero crossings to avoid the disturbing effects that many early pieces of test equipment could not properly provide.

Tracks 76 to 78 contain impulse test signals which are extremely useful for testing both the CD player, your loudspeakers and a wide range of high fidelity and professional equipment — but be careful, these signals can wipe out your tweeters if you aren't careful with the volume control settings!

Track 79 is a band of 120 seconds of 'white' noise with a genuine 20 kHz bandwidth, derived digitally with what is described as an 'M'-sequence dither. This signal is absolutely perfect for conducting A-B tests between pairs of loudspeakers, *and just by itself would justify the purchase of this disc.* ▶

SOUND REVIEW

Tracks 80 to 89 are most probably the 'piéce de résistance' of the disc. They contain a series of ⅓-octave bands of signal between 25 Hz and 16 kHz on the left channel and matching octave bands of signal centred on 31.5 Hz through to 16 kHz on the right channel (see Figure 1).

These signals are arranged so that while the left channel steps through three contiguous ⅓-octave bands, the right channel provides the corresponding octave band signal. You are thus able to generate at will the ⅓-octave band or single octave bands for listening to your loudspeakers, for testing your tape recorder, for assessing your room characteristics, and if your loudspeakers are good enough, for assessing your own hearing acuity or that of your relatives and friends.

This facility is undoubtedly worth many times the cost of the disc. I will be using it in future loudspeaker subjective assessments as it will save me the trouble of bringing home the 50 kg or so of test equipment that I have had to carry in the past!

Track 90 contains a band of 'pink' noise which is also invaluable for loudspeaker testing. Track 91 provides a superb 3150 Hz test sine wave for 'wow and flutter' measurements (but this requires access to a wow and flutter meter).

Track 92 contains a test signal wich is FFFF/0000 at 22.05 kHz for testing CD player out-of-band ('anti-aliasing') filters and consequently is inaudible to mere mortals.

Tracks 93 to 96 contain a series of orchestral and piano music at normal stereo level, −20 VU, −40 VU and −60 VU. This is extremely useful for evaluating both your CD player and the loudness contours and noise generation characteristics of your amplifier/speaker system. If nothing else, it will tell you how good or bad the background listening levels are in your room. If you live in a noisy location you may be tempted to move as a result!

Tracks 97 to 99 contain three classical samples of music, each repeated four times for A-B testing of amplifiers and loudspeakers, which once again prove to be an excellent set of test material.

Conclusions

If by now you are not 'chaffing at the bit' to buy this disc, then it's clear that you are not seriously involved with hi-fi. I classify this particular CD test disc as one of the best bargains of 1984. I believe that almost every recording studio, radio station, television station and serious hi-fi enthusiast will want to buy this particular disc because it provides *so much invaluable testing information.*

The information has been produced with a degree of precision which has never before been matched by any other means for so little cost. Having checked the main parameters, I can now attest to its precision, accuracy and usefulness. (I kept the disc.)●

A special opportunity for readers of Electronics Today

By special arrangement with Teac Australia Pty Ltd, the local representatives for Denon, we are able to offer readers the outstanding new Denon Technical CD Test Disc for only

$19.95 *Plus $2.50 postage and handling*

This important new tool for evaluating CD players and testing audio systems comes from Denon, the Japanese company that has played a leading role in the development of digital audio recording. Here's what Louis Challis, Australia's foremost audio and electronic equipment reviewer, said after testing this exciting new disc in his NATA-registered laboratory:

"I classify this particular CD disc as one of the best bargains of 1984. I believe that almost every recording studio, radio station, television station and serious high fidelity enthusiast will want to buy this particular disc, because it provides just SO MUCH INVALUABLE (testing) INFORMATION."

(Electronics Today, August 1984)

This is an excellent offer for such a professional, state of the art disc! Look at what you get for just $19.95:

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- Test signals for basic performance checks.
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• 1% Metal Film Resistors are used where possible • Prewound Coils are supplied • Aluminium case as per the original article • All components are top quality • Over 400 Kits now sold • We have built this unit and so know what needs to go into every kit • SUPER FINISH Front panel supplied with every kit at no extra cost to you. • We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. four weeks after placement.

PREAMPLIFIER **Only $449**

KIT PRICE $289 P&P $12.00

• 1% Metal Film Resistors are supplied • 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes) • English "Lorlin" Switches are supplied no substitutes as others supply • We have built and tested this unit and so know what needs to go into every kit • Specially imported black anodised aluminium knobs • Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the PA.

PREAMPLIFIER Kit Price $289, P&P $12.00

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

On Special at $259
Normally $289

**All parts available separately for both kits.*

POWER AMPLIFIER Kit Price $319, P&P $12.00

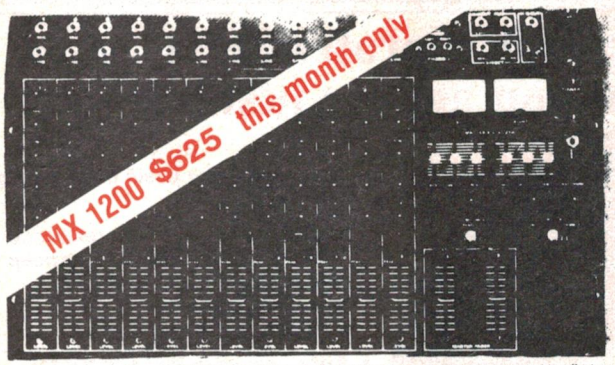
SPECIFICATIONS 150W RMS into 40hms

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0 −0.4 dB 2.8-Hz to 65 kHz, +0 −3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	100dB below full output (flat).
Noise:	—116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. 0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

On Special at $299
Normally $319

MX-1200 MICROPHONE/AUDIO MIXER

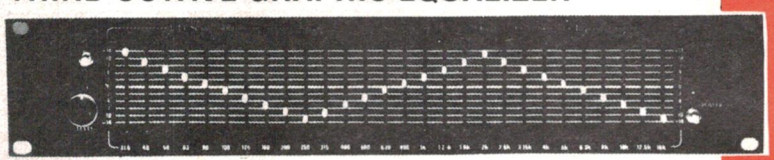


This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross-fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

SPECIFICATIONS:
INPUTS
Level/Impedance Mic 46 db/1K
Line 22 db/16K x 12
Phono 52 db/50K STEREO x 2 (2mv) at 1KHz
Effect Return (Aux) 20 db/50K x 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader: Slide, 60m/m, LOG 25%
2 Master fader: Slide, 60m/m, LOG 15%
12 F/B Volume, 300, LIN
1 F/B Master level, 300, LIN
12 Effect Send, 300, LIN
1 Effect Return, 300, LOG 15%
2 Phono, 300, LOG 15%
1 Head Phone, 300, LOG 15%
S/N: 58DB
FREQUENCY RESPONSE: 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER: 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE: 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise:	<0.008 mV, sliders at 0, gain at 0 (−102 dB), 20 kHz bandwidth
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0 max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

$195.00 1 Unit
$379.00 2 Units

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Low cost handheld DMM

Rod Irving Electronics has just released details of a new addition to their extensive range of multimeters.

It's the YFE YF1100, a 3½-digit machine priced to undersell the opposition at $59.95. It comes with facilities for transistor and diode testing. The YF1100 has a large, easy-to-read liquid crystal display and clearly laid out front panel.

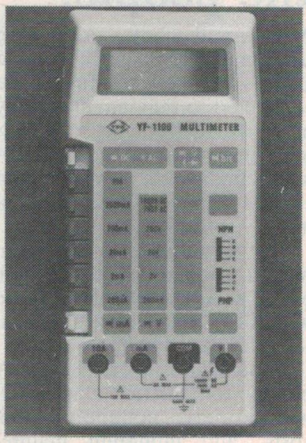
Function and range control is via a set of side buttons. There are six ranges of current and resistance, and five of volts. It will accept currents from two microamps through to 10 Amps. There are separate jacks for the ranges up to two amps and the 10 amp range. Both are fuse protected to save the meter in the event of misuse. It is designed to be able to tolerate 500 V across the current jacks.

The YF1100 will measure up to 1000 Vdc and 750 Vac and up to 20M of resistance.

It will also measure the Hfe of a transistor. Separate jacks are provided for pnp and npn transistors. To increase the flexibility of the jacks there are two emitter terminals on each jack commoned together, so that any transistor can be fitted, irrespective of its orientation.

The YF1100 also has diode testing facilities and the ability to test resistance both with and without turning on semi-conductor junctions.

For more information contact **Rod Irving Electronics, 425 High St, Northcote Vic 3070. (03) 489-8866.**



The YF1100, a 3½-digit multimeter from Rod Irving.

Quick tip cleaning

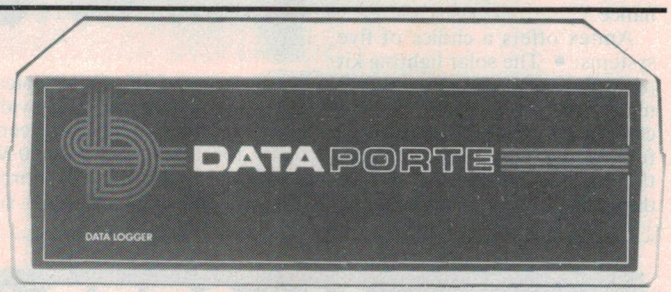
Delicate soldering requires accurately cleaned soldering-iron tips and this new cleaner Clean-o-Point solves and eliminates many of the problems that crop up using old fashioned, home made devices.

'Clean-o-Point' has been designed for on-bench use and contains a motorised pair of sponge rollers. The soldering-iron tip is placed between the rollers and tin alloy, liquid and residue are wiped off and fall within a receptacle designed exclusively to retain used solder.

Solder spray which normally occurs when wiping the tip is eliminated and since the heating element does not come into contact with the damp sponge rollers it retains an even temperature. The cleaning action is thorough, quick and avoids any necessity for visually checking the tip.

'Clean-o-Point' helps to achieve an increase in soldering quality and enables recycling of solder normally lost in the cleaning process.

For further information contact **C & K Electronics, 15 Cowper Street, Parramatta NSW 2150. (02)636-0799.**



Smart data logger

Data Electronics has just announced the release of a new data logger. The Dataporte is a high performance data acquisition, data logging and controlling unit, suitable for a wide variety of applications.

Standard features of the Dataporte include analogue, digital, event and counter inputs, data averaging, data storage, analogue and digital outputs, set-point control and alarm outputs, real time clock, RS232C/RS423 ASCII communications, and simple programming.

The Dataporte is programmed from a computer or terminal, and may be continually supervised, or operated in a stand-alone mode. The 24 analogue inputs accept voltage, current, resistive and frequency signals, and are self-calibrating, and autoranging over three decades.

The eight digital/counter inputs are debounced, and allow state and even monitoring, and counting. Scan rates are programmed as a function of time or events detected on digital or counter channels.

The eight digital outputs may be manged directly by the user, or programmed as a function of selected analog inputs to provide direct control and alarm functions, or analog front-ending to PLC's.

Dataporte is designed and manufactured in Australia by Data Electronics (Aust.) Pty Ltd. More information is available by contacting the manufacturer at **4 Pilgrim Court, Ringwood Vic 3134. (03)874-7066.**

New sound lever meter

Cirrus Research has announced the CRL 2.35A Measuring System. At the input socket, the whole range of L3M microphone pre-amplifiers or input units is available together with eight different microphone capsules. These give a total measurement range from 10 to 160 dB at all grades of the International Standard IEC 651 up to and including Precision Grade 1, totally covering Australian Standard 1259 parts two and three.

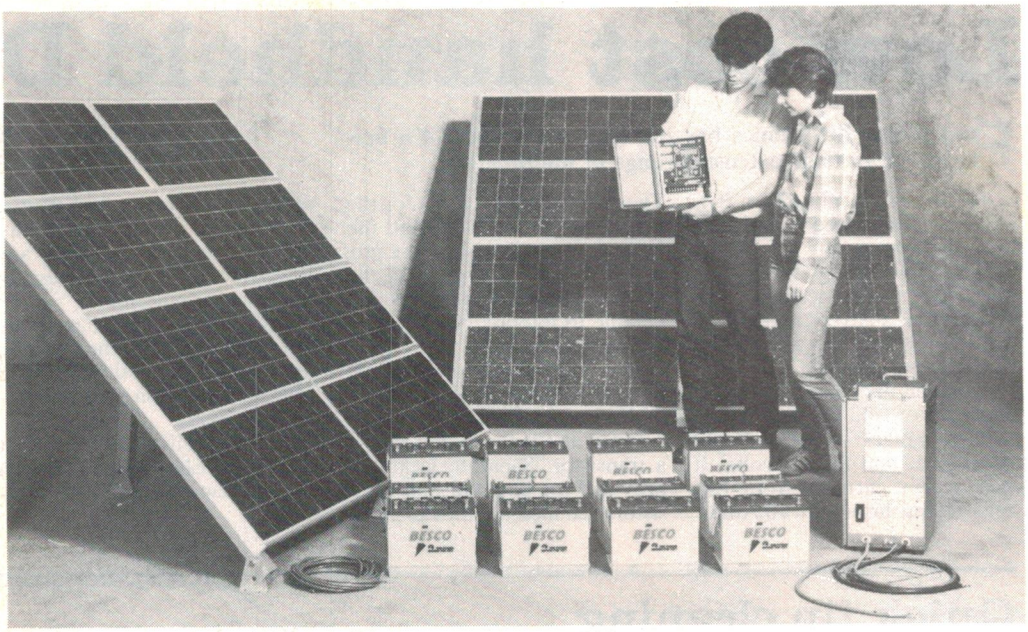
Nine plug-in units are currently available for the DP15 function interface. These have all the parameters expected of a current technology sound level meter, including not only octave filter (to AS Z41), L_{eq} and D_{ose}, but also vibration, speed measurement, digital readout, ac power drive and many others.

The main body of the CRL 2.35 A has an input sensitivity of 0.5 μC to 7 V over a bandwidth of 8 Hz to 32 kHz, while the main amplifier covers the whole range from infrasound to ultrasound.

Functionally, the CRL 2.35A features a new, clear, 34 dB mirror scaled meter which displays current sound level and maximum held value. This meets the Australian Standard at all three response speeds permitting the use of 'Max Hold' to full specification.

The price of a typical system, with plug-in units for multiple functions, is usually well under $2000. For further information contact **M. B. & K. J. Davidson Pty Ltd, 66 Atherton Road, Oakleigh Vic. 3166. (03)568-1933.**

Power to the people!



Thousands of Australian homes are in such remote areas that they will never be connected to regional electricity networks. But thanks to a Sydney company, even the most isolated families can now obtain an endless supply of 'free' electricity . . . from the sun.

"If your home is not connected to mains electricity, you either generate your own, or do without," said Amtex Electronics' manager, Jim Kuswadi.

"You can convert the Sun's energy to electricity instantly, with no noise, pollution or fuel costs, and minimum maintenance."

Amtex offers a choice of five systems: • The solar lighting kit provides four hours of light each night from three 13 W fluorescent lamps. In sunless periods, a fully-charged battery will keep the system operating for five days or more. • The home power system (dc); On a typical day, this system could provide power for four 20 W fluorescent lights for three hours, a 50 W portable colour TV for three hours, a transistor radio for six hours, and a small water pump for half an hour. • 240 V ac systems are available in small, medium and large sizes, to meet customers' varying requirements. These units supply power for most 240 V domestic appliances.

For further information, contact: **Jim Kuswadi, Amtex Electronics, 36 Lisbon St, Fairfield NSW 2165. (02)728-212 1.**

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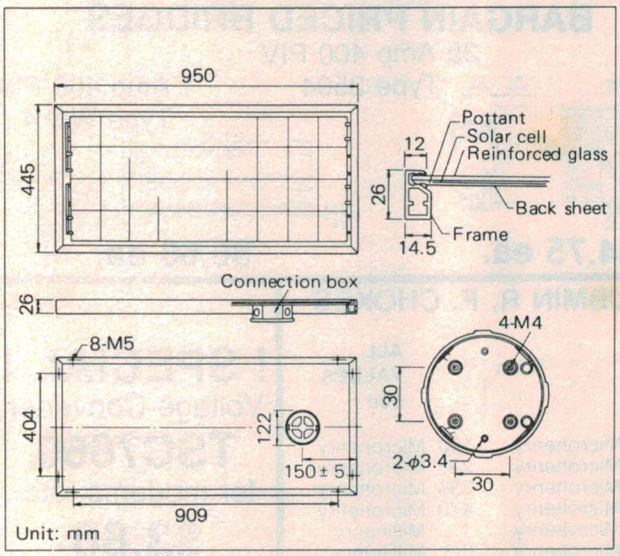
DIMENSION OF PSA100H-361



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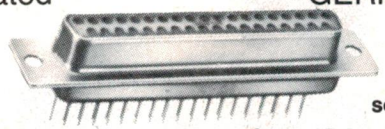

plug — socket

9 way ADS 9L $1.95	9 way ADF 9L $2.40
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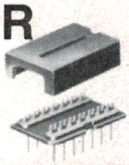

A8D $1.20	A24P $3.10
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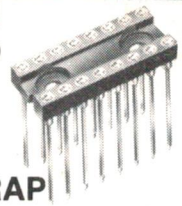

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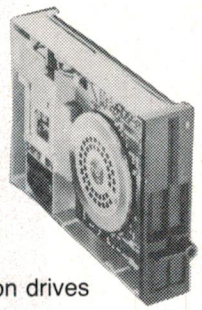

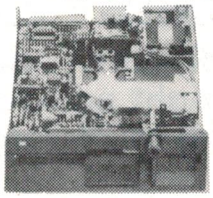

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Part No.	Sides	Density	Tracks	Cap.	Price
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FB.503	Double	Single	48tpi	500K	$305.00
FB.504	Double	Double	96tpi	1M	$335.50

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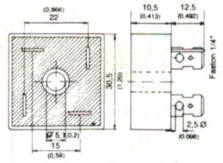
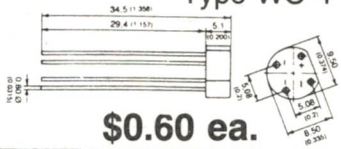
35 Amp 400 PIV
Type 3504



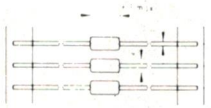
$4.75 ea.

1 Amp 400 PIV
Type WO 4



$0.60 ea.

SUBMIN R. F. CHOKES



ALL VALUES 50c

2.2	Microhenry	100	Microhenry
3.3	Microhenry	220	Microhenry
4.7	Microhenry	330	Microhenry
10	Microhenry	470	Microhenry
22	Microhenry	1	Millihenry
33	Microhenry	3.3	Millihenry
47	Microhenry	4.7	Millihenry

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Voltage Converter
TSC7660
for modems, etc.
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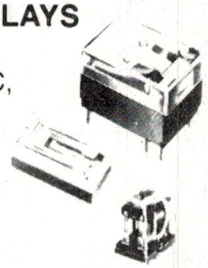

1 c/o 6V type 6V103	$2.50
1 c/o 12V type 12V103	$2.50
1 c/o 24V type 24V103	$2.50
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2 c/o 12V type 12V104	$3.75
2 c/o 24V type 24V104	$3.75

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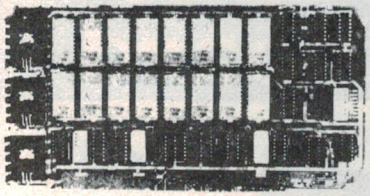

$109.00

USES 2716's

Blank PC Board — $69

ASSEMBLED & TESTED
ADD $49.00

KIT FEATURES

1. Uses +5V only 2716 (2Kx8) EPROM's
2. Allows up to 32K of software on line!
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4. Addressable as two independent 16K blocks
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6. On board wait state circuitry if needed
7. Any or all EPROM locations can be disabled
8. Double sided PC board, solder masked, silk-screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and [illegible]
12. Easy and quick to assemble

64K S100 STATIC RAM

$499.00 KIT

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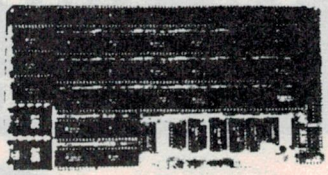
LOW POWER!

RAM OR EPROM!



BLANK PC BOARD WITH DOCUMENTATION $119.00

SUPPORT ICs + CAPS $29.00

FULL SOCKET SET $19.00

FULLY SUPPORTS THE NEW IEEE 696 S100 STANDARD (AS PROPOSED)

FOR 56K KIT $419

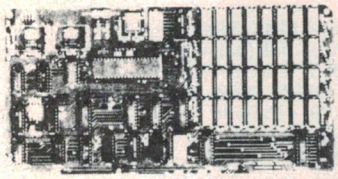
ASSEMBLED AND TESTED ADD $50

FEATURES:

- Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- Fully supports IEEE 696 24 BIT Extended Addressing.
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- 2716 EPROMs may be installed in any of top 48K.
- Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- BOARD may be partially populated as 56K.

256K S-100 SOLID STATE DISK SIMULATOR!

WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.



FEATURES:

- 256K on board, using + 5V 64K DRAMS.
- Uses new Intel 8203-1 LSI Memory Controller.
- Requires only 4 Dip Switch Selectable I/O Ports.
- Runs on 8080 or Z80 S100 machines.
- Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
- Provisions for Battery back-up.
- Software to mate the LS-100 to your CP/M* 2.2 DOS is supplied.
- The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
- Compare our price! You could pay up to 3 times as much for similar boards.

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$699.00

#LS-100 (FULL 256K KIT)

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64K SS-50 STATIC RAM

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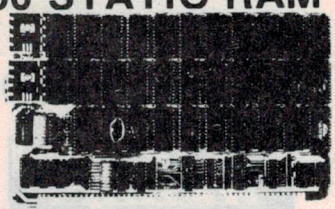

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RAM OR EPROM!

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SUPPORT ICs + CAPS

FULL SOCKET SET

56K Kit $419
64K Kit $499

ASSEMBLED AND TESTED ADD $50

FEATURES:

- Uses new 2K x 8 MK58725P RAMS
- Fully supports Extended Addressing.
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- Board is configured as 3-16K blocks and 8-2K blocks (within any 64K block) for maximum flexibility.
- 2716 EPROMs may be installed anywhere on Board.
- Top 16K may be disabled in 2K blocks to avoid any I/O conflicts.
- One Board supports both RAM and EPROM.
- RAM supports 2MHZ operation at no extra charge!
- Board may be partially populated in 16K increments.

THE NEW ZRT-80

CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

FEATURES:

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- Optional formats from 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
- Higher density formats require up to 3 additional 2K x 8 6116 RAMS.
- Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
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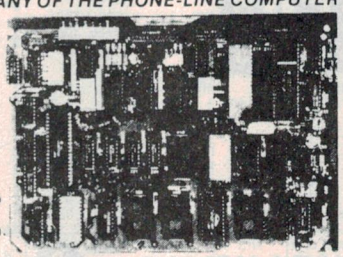

BLANK PCB WITH 2716 CHAR. ROM, 2732 MON. ROM $99.00

SOURCE DISKETTE – ADD $20

SET OF 2 CRYSTALS–ADD $12

ZRT-80

WITH 8 IN. SOURCE DISK! **$219.00** (COMPLETE KIT, 2K VIDEO RAM)

32K S100 EPROM/STATIC RAM

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NEW!

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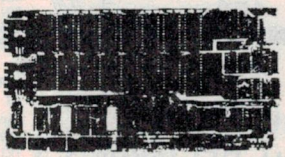

BLANK PC BOARD WITH DATA $69.00

SUPPORT IC'S PLUS CAPS $29.00

FULL SOCKET SET $25.00

We took our very popular 32K S100 EPROM Card and added additional logic to create a more versatile EPROM/RAM Board.

FEATURES:

- This one board can be used in any one of four ways:
  - A. As a 32K 2716 EPROM Board
  - B. As a 32K 2732 EPROM Board (Using Every Other Socket)
  - C. As a mixed 32K 2716 EPROM/2K x 8 RAM Board
  - D. As a 32K Static RAM Board
- Uses New 2K x 8 (TMM2016 or HM6116) RAM's
- Fully Supports IEEE 696 Buss Standard (As Proposed)
- Supports 24 Bit Extended Adressing
- 200 NS (FAST!) RAM'S are standard on the RAM Kit
- Supports both Cromemco and North Star Bank Select
- Supports Phantom
- On Board wait State Generator
- Every 2K Block may be disabled
- Addressed as two separate 16K Blocks on any 64K Boundary
- Perfect for MP/M* Systems
- RAM Kit is very low power (300 MA typical)

32K STATIC RAM KIT — $199.00

For RAM Kit A&T - Add $40

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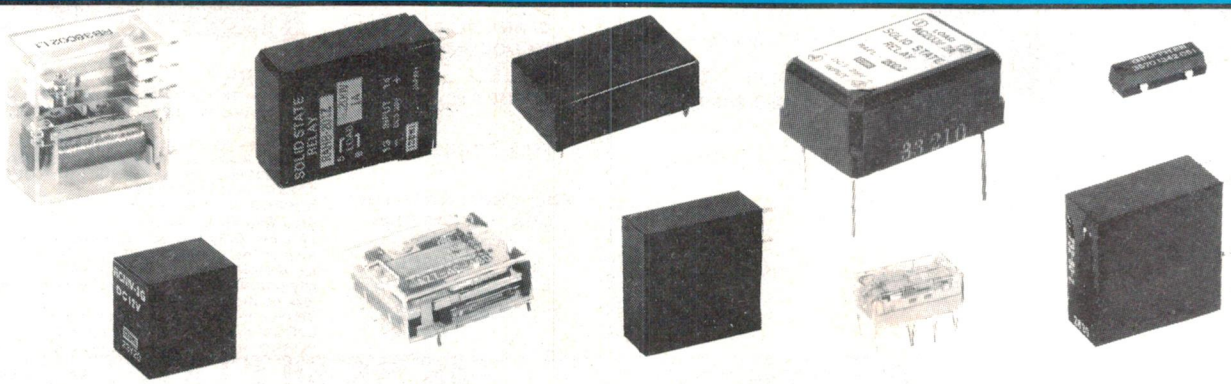

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Throw out your fuses

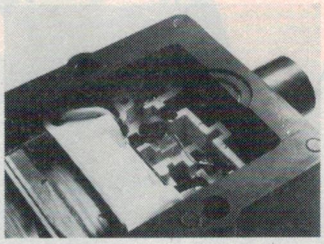
Philips has introduced a range of thermistors especially designed to replace fusable links.

The extended range of positive temperature coefficient thermistors are rated at 56 V and 256 V. They are automatically resettable, fast, reliable and have clearly specified, guaranteed current switching levels to simplify selection.

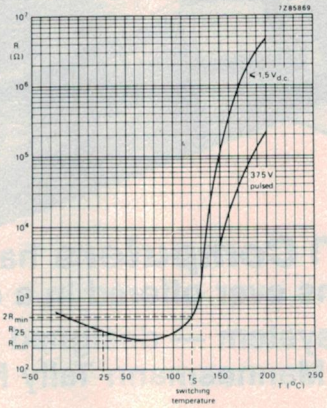
Philips claim the devices can often replace bimetal switches and fuses, and are ideal for protecting any electrical/electronic circuit in consumer products or industrial equipment. Applications include the protection of battery operated toys, hairdryers, kitchen appliances, loudspeaker output circuits, semiconductor circuits, small motors and transformers.

The thermistors act as current sensors for connection in series with the load. At I_t (trip current) the resistance jumps from low to very high, limiting the circuit current and protecting the load. Below I_t the voltage drop across the thermistor is less than 6% of the operating voltage due to the thermistor's low resistance at ambient temperature.

The current switching levels range from a few mA to over 1 A and are guaranteed stable throughout the life of the thermistor. Operating temperature range at minimum voltage is 0 to +55°C.



Protected! A Philips thermistor *in situ*, acting as overload protection for a transformer.



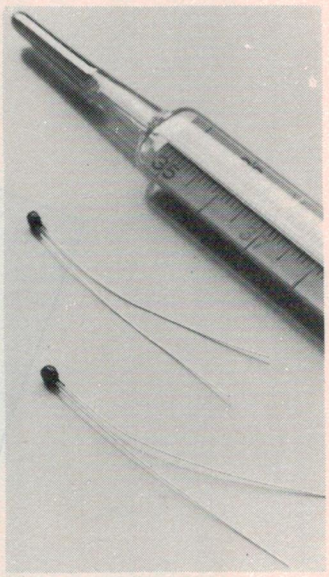
For further information contact **Philips, 67 Mars Road, Lane Cove, NSW.**

Accurate NTC thermistor

For electronic themometers with a resolution of one tenth of a degree, Siemens has introduced the NTC thermistor M 841. The sensor operates over the entire body temperature range of 30°C to 50°C with a resolution of less than 0.1°C, which corresponds to a resistance tolerance of ±0.4%

The new NTC thermistor with its 20 mm long, silver-plated leads can be operated in the range between −40°C and +100°C. Rated resistance values are 3k or 5k; versions up to 100k are in the course of preparation. Other applications are in automotive electronics, heating and air conditioning and warning devices.

For more information contact **Siemens, 544 Church St, Richmond Vic 3121. (03)429-7111.**



Super accurate! The latest generation of NTC thermistors.

Dual power MOSFET driver

The TSC426/427/428 are dual CMOS high speed drivers, available from Promark Electronics. A TTL/CMOS input voltage level is translated into an output voltage level swing equalling the supply. The CMOS output will be within 25 mV of ground or positive supply. Bipolar designs are capable of swinging only one volt of the supply.

The low impedance high current driver outputs will swing a 1000 pF load 18 V in 30 ns. The unique current and voltage drive qualities make the TSC426/427/428 ideal power MOSFET drivers, line drivers and dc-to-dc converter building blocks.

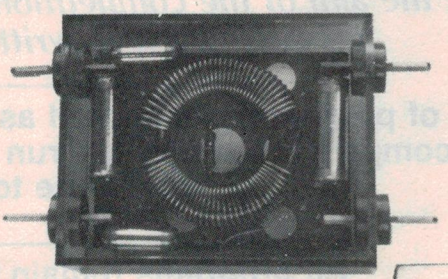
For more information contact **Promark Electronics, PO Box 115, Nunawading Vic 3131. (03)878-1255.**

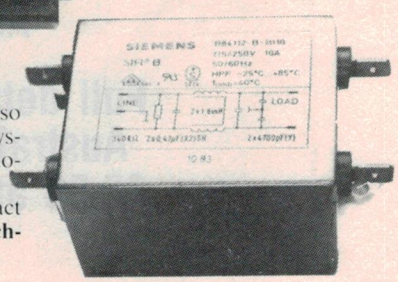
Line filters

At this year's Hanover Fair Siemens showed a virtually complete range of power line filters, now comprising nearly 50 variants (all of them two-wire filters). Under the collective name 'Sifi', four series (B 84111/2/3/4) are now available with graduated attenuation values (normal/medium/very high/extra high).

Symmetrical insertion loss is up to 80 dB; the permissible current ratings are divided into six classes, from 1 to 20 A. There are different types of mounting and filters with equipment plugs for facilitating installation in the EDP system power line. The most popular styles are now stocked in Australia.

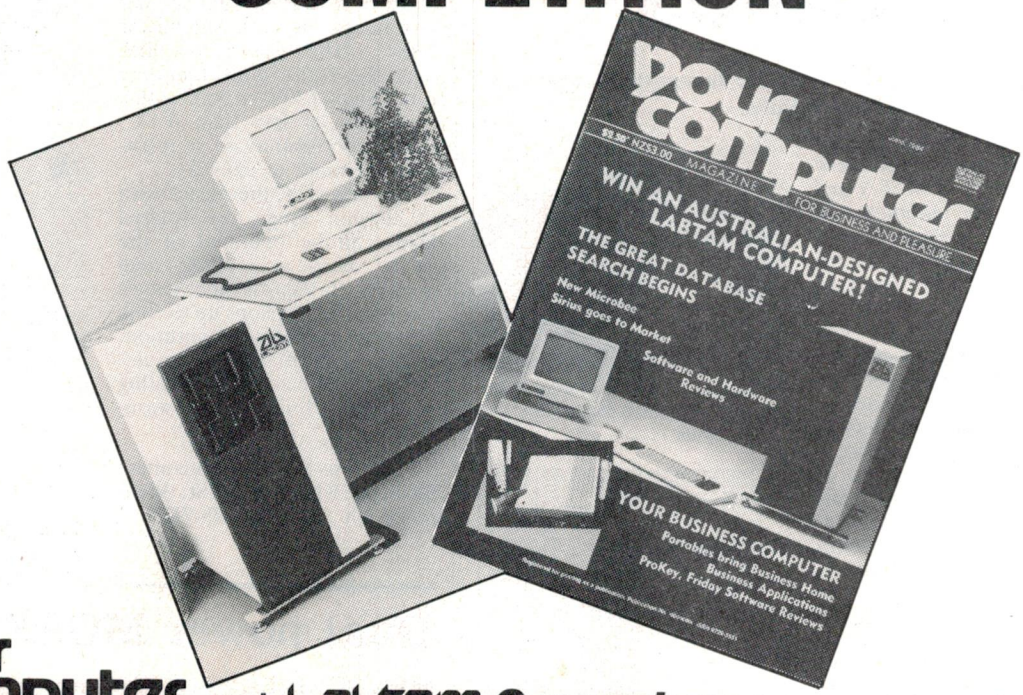
Usually, for equipment with a linear power section, RFI can be effectively suppressed using filters with only normal attenuation (B84111, immunity : 1 MHz). Power sections with secondary pulsing, however, require filters with medium-range attenuation values (B84112, immunity : 0.1-100 MHz), and power sections and transistor/thyristor switches with primary pulsing require filters with very high attenuation values (B84113/4, immunity: 0.01-100 MHz). 'Sifi' filters are also suitable for microprocessor systems, office equipment and domestic appliances.





For more information contact **Siemens, 544 Church St, Richmond Vic 3121. (03)429-7111.**

THE GREAT AUSSIE SOFTWARE COMPETITION



your computer MAGAZINE and **Labtam Computers** have got together to run one of the most exciting competitions ever offered in a computer publication.

The prize is a Labtam 3006 computer system — designed and built in Australia t top specifications — plus a Mannesmann Tally MT160 printer.

Total value $14,000

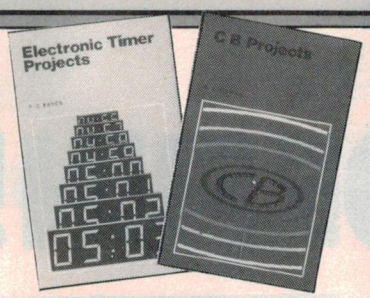
All you have to do is write an original, innovative program for any application o your choosing. It doesn't have to be a super complex program, or even business orientated; the aim of the competition is to reward original Australian initiative i producing a well written, well structured program.

Groups of programmers as well as individuals are encouraged to enter the competition, which will run in Your Computer in four issues, from June to September 1984.

All programs remain the property of the authors.

Full details are in the current issue of Your Computer Australia's largest selling microcomputer magazine $2.50 at all leading newsagents and computer stores

Construction Projects



AERIAL PROJECTS
D0064B ***$6.75***
Practical aerial designs including active, loop and ferrite which are relatively simple and inexpensive to build. Theory and mathematics are avoided.

CB PROJECTS
D0055B ***$6.75***
A number of useful designs include a speech processor, interference filters and a simple CB radio receiver. Stripboard layouts, wiring diagrams and notes on construction are provided.

POPULAR ELECTRONIC CIRCUITS — BOOK 2
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A wide range of designs for electronics enthusiasts who are capable of producing working projects from just a circuit diagram withut the aid of detailed information.

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Essential for keen hi-fi and audio enthusiasts. Projects include stereo decoder, three-channel mixer, FET preamp for ceramic pick-ups, mic preamp with adj. bass, stereo dynamic noise limiter, loudspeaker protector, etc.

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D0053B ***$4.50***
Some circuits are new, others are familiar designs. Projects can be split and/or combined.

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These may have a high degree of accuracy with quartz control or they may be quite simple designs, using only a few components. A number of specialist timer projects are car windscreen-wiper delay unit, darkroom timer, metronome, etc.

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Fifteen fairly simple projects designed for use with 12V electrical systems but in some cases can also be employed with 6V and/or positive earth systems.

BUILDING AND INSTALLING ELECTRONIC INTRUSION ALARMS
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Electromechanical intrusion alarms, audio and vibration alarms, photoelectric alarms, proximity alarms and car alarms are all covered in this book. Hints on selection, construction, installation and maintenance are also included.

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ELECTRONIC SCIENCE PROJECTS
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Twelve electronic projects with a scientific flavour — each project includes details on how it works, construction and use. Includes a simple infra-red laser, a low-cost solid-state oscilloscope, a pH meter, and electronic stethoscope and an electronic seismograph.

POWER-SUPPLY PROJECTS
D0047B ***$5.95***
Gives a number of power-supply designs, including simple unstabilised types, fixed-voltage regulated type and variable voltage stabilised designs. The designs are all low-voltage types for semiconductor-circuits.

PROJECTS IN OPTO-ELECTRONICS
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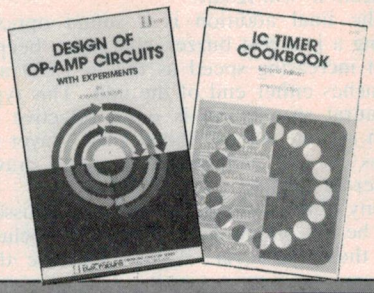

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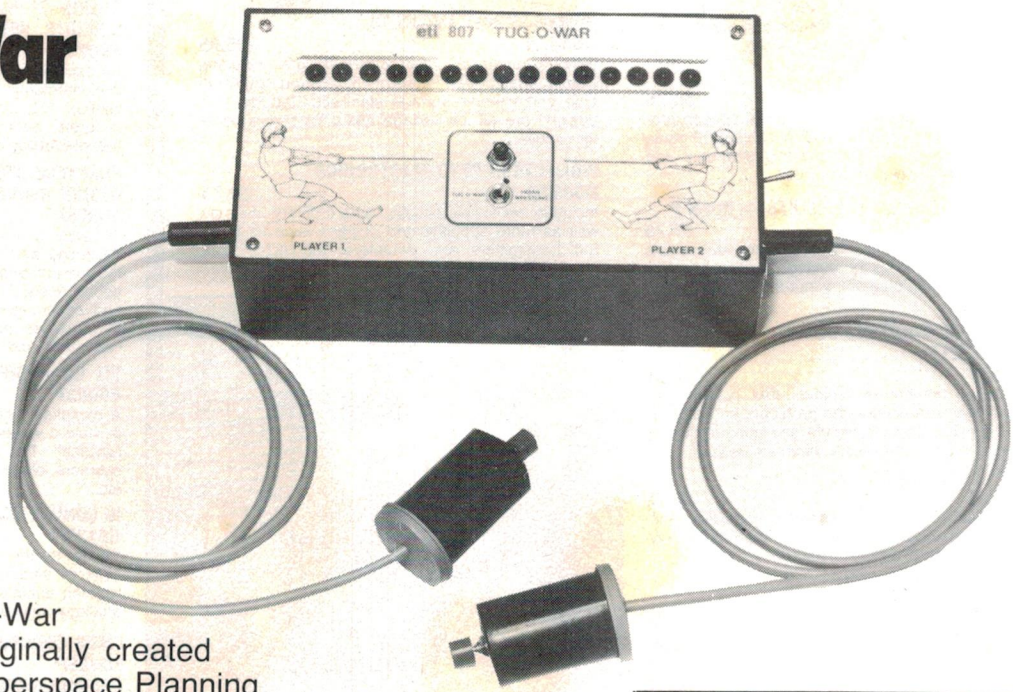
HOURS OF FUN!

Tug-O-War Game

Peter Ihnat



Try our electronic intergalactic Tug-O-War decision maker! Originally created for the Galactic Hyperspace Planning Council, you can build and use it right in your own home.

IT'S BEEN SOME TIME now since we published a simple row-of-LEDs type game. This project is quite simple to build and play but has a special challenge all its own. The Tug-O-War consists of a row of 15 LEDs, one of which is lit at any time. To start a game, press the reset button and the middle LED will come on. You and your opponents are each armed with a pushbutton. By rapidly and repeatedly pressing your button, you try to 'pull' the LED which is on towards your end of the unit, as does your opponent. Each pushbutton press causes the LED on your side of the LED currently on to light. So with no opponent, the LED closest to you will light after seven presses. The same goes for your opponent. The aim of the game then is to win by 'pulling' the lit LED down to your end of the unit by pressing your pushbutton as fast as possible.

Easy, I hear you say. Don't be fooled by the apparent simplicity! After many battles fought in the ETI lab, we noticed that intense concentration is required to win — a laugh, cough or any distraction can lose you some LED positions which are hard to regain (a jab in the opponent's ribs usually distracts them long enough for you to catch up). Another observation was that anyone who plays arcade video games regularly has a noticeably higher button-pushing speed and can maintain it over relatively long periods of time (i.e: Geoff Nicholls wins most times!).

Extra features

Three minor additions to the basic game are incorporated in this project. Firstly, I have included a 'game select' switch for those who would rather *push* the lit LED away from their side instead of *pulling* it towards them. In one position, the game played is *Tug-O-War* (pull towards you); in the other position it is *Indian Wrestling* (push away from you). But note that the direction of LED movement is the only difference between the two games.

Secondly, I've connected each of the end LEDs back into the circuit so that when either is reached, the circuit latches and further presses of the pushbuttons are ignored. If flashing LEDs are used in the end positions, then a very effective 'win indication' will result!

The final addition is a sound option. Using a low cost buzzer, the game 'beeps' with increasing speed as the lit LED approaches either end of the unit. This type of aural stimulation is quite effective in such a game since it induces the player to press his pushbutton faster as he draws closer to winning.

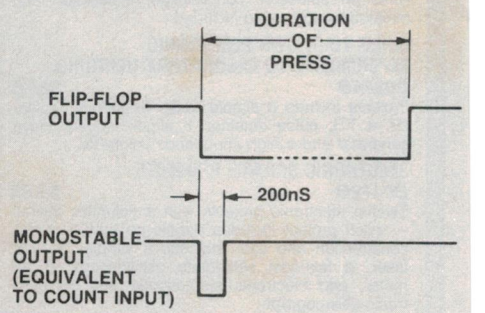
Any of the three additions just discussed can be left off the current project. Including them, however, doesn't increase the

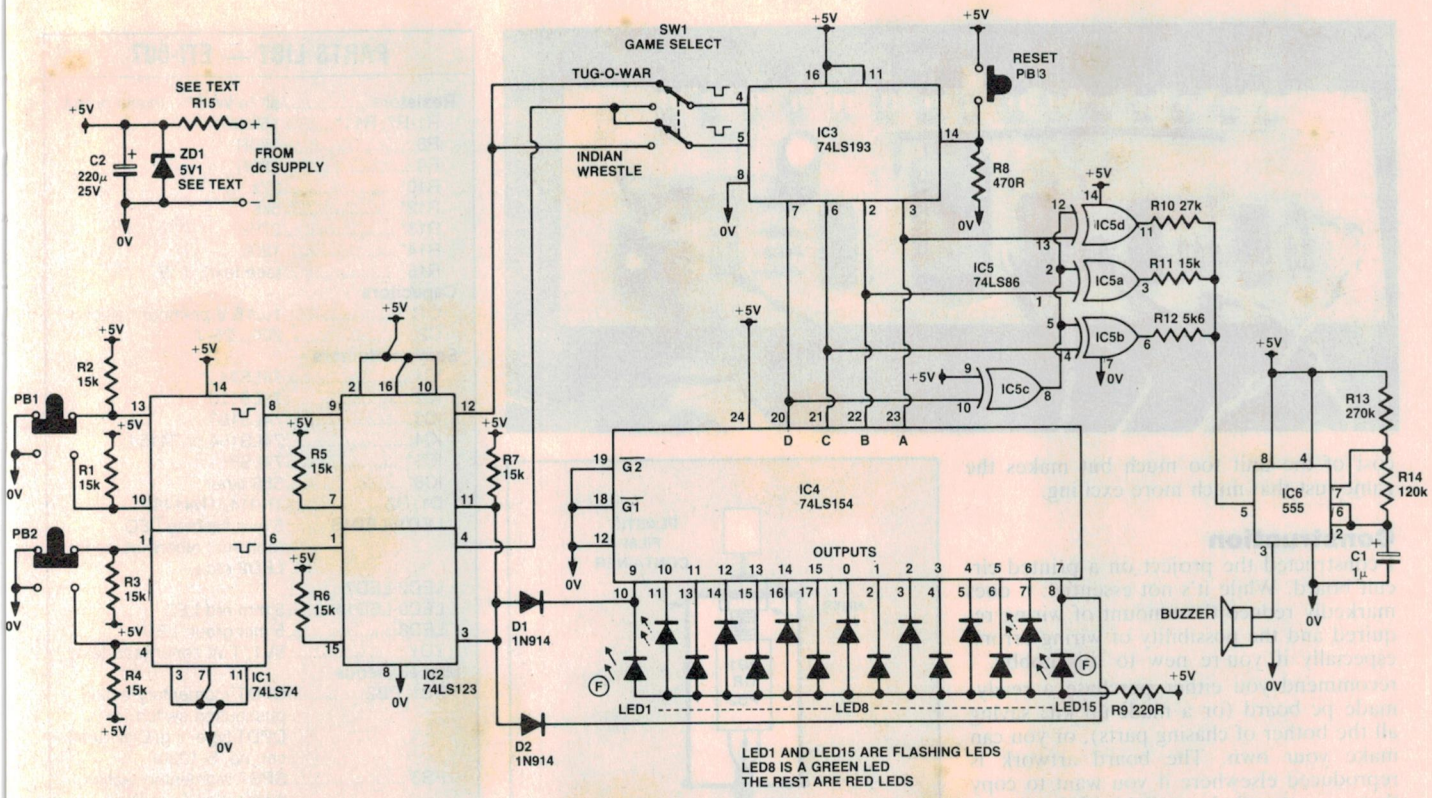
HOW IT WORKS ETI-807

The heart of the game revolves around IC3 and IC4. IC3 is a binary up/down counter which has two clock inputs — count up and count down. Its four outputs feed IC4 which is a 4-to-16 line decoder. Its 'truth' table, showing its complete operation, is given in Table A.

Only one of its outputs will be low (0) at any time — which output depends on the value applied to its four inputs. For example, 0000 on the inputs causes output 0 to go low; 0111 on the inputs causes output 7 to go low. Here, 15 LEDs are connected to these outputs and their common side goes to +5 volts through the current limiting resistor R9. The state of the counter determines which one of the LEDs will be on.

In basic terms, a player feeds pulses into either the *up* or *down* count input of the counter. This causes the next LED either left or right of the lit LED to light, depending on which player pressed his button.





*For a guide to buying components and kits see **SHOP AROUND** this issue.*

The middle LED is fed from output 0 and is the one that lights when RESET is pressed. Seven LEDs are placed either side of the middle giving 15 in total. Output 8 is not used.

IC1 and IC2 are used to 'condition' the inputs to prevent the quality of the pushbuttons from affecting the outcome of the match. Otherwise, a switch with bad contact bounce will give that player too much of an advantage.

IC1 is a dual D flip-flop but is not used as such. Each of its flip-flops has a $\overline{\text{CLEAR}}$ and $\overline{\text{SET}}$ input and these are used to 'debounce' the pushbuttons. The output from the flip-flop is normally high, going to low when the button is pressed and returning high when released.

IC2 is a dual monostable which produces a very short, active-low pulse on the falling edge of its input (see the timing diagram). These short pulses are used to clock IC3. The GAME SELECT switch simply interchanges the counter's clock inputs.

To stop the game when a LED reaches one end, diodes D1 and D2, and resistor R7, form a simple NOR gate which controls the $\overline{\text{CLEAR}}$ input of the monostables. During the game, R7 pulls the $\overline{\text{CLEAR}}$ high so that the monostables can function properly. When either end of the row of LEDs is reached, the $\overline{\text{CLEAR}}$ is pulled low, preventing the game from continuing.

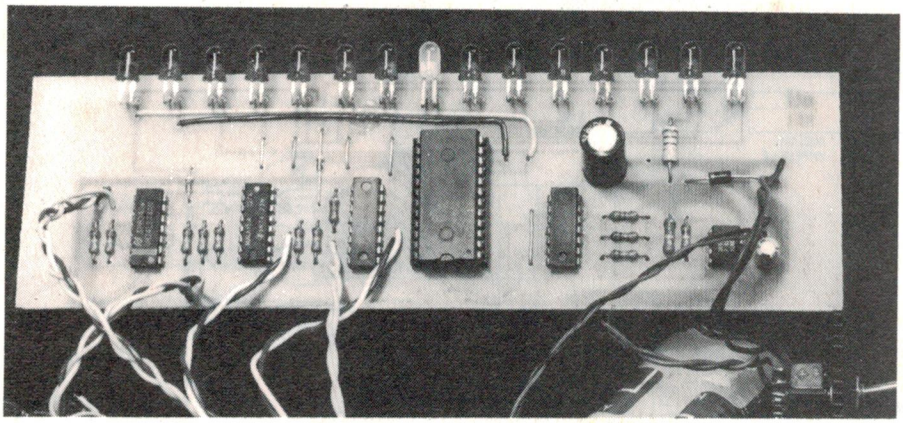
The sound option basically consists of a low cost buzzer and a 555 timer running as a low frequency astable oscillator. Each time the 555 output goes high, the buzzer sounds. To control the speed of beeping, R10, R11 and R12 change the voltage at the control input of the 555. This voltage is very roughly proportional to the binary output of the counter. Normally, these resistors would connect directly to the counter's outputs and the beeping speed would increase as the counter went from 0000 to 1111. However, in this project, the slowest beeping speed should occur when the counter outputs 0000 and it should increase as it counts from 0001 to 0111 or from 1111 down to 1001 (because 0000 was chosen to correspond with the middle LED position).

IC5 is used to invert the three lower bits of the counter, feeding R10 to R12 only when the most significant bit is high. This almost works correctly except that the speed of beeping corresponding with counter outputs 0000 and 1111 are the same. This is not all that noticeable when playing the game and besides, isn't worth the expense of extra circuitry to solve the problem.

TABLE 1: Truth table for 75154

INPUTS						OUTPUTS															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

X = "Don't Care" Condition



cost of the unit too much but makes the game just that much more exciting.

Construction

I constructed the project on a printed circuit board. While it's not essential, it does markedly reduce the amount of wiring required and the possibility of wiring errors, especially if you're new to this hobby. I recommend you either purchase a ready-made pc board (or a made-up kit, saving all the bother of chasing parts), or you can make your own. The board artwork is reproduced elsewhere if you want to copy that, or artwork is available through out artwork service (see the 'Shoparound' page this issue).

The front panel I 'dressed up' with a plastic Scotchcal label. Like pc boards, these are quite easy to make (see ETI September 1977, Photostats of this article are available through ETI Reader Services, see page 3 this issue). If you purchase a made-up kit though, a Scotchcal label will likely be included. The box I used is a common plastic 'zippy' box.

Begin construction by first checking the pc board, whether you bought it ready-made or etched it yourself. Make sure that there are no broken tracks, small links between close tracks or incorrectly drilled holes. If all is well, then mount and solder the seven wire links as shown on the component overlay diagram. Note that the five short links can be bare wire, whereas the longer two should be insulated hookup wire as a precaution against shorts.

Next, insert and solder the resistors, capacitors, diodes, and finally the ICs.

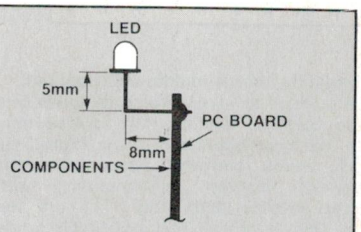


Figure 1. Showing how the LEDs are all mounted.

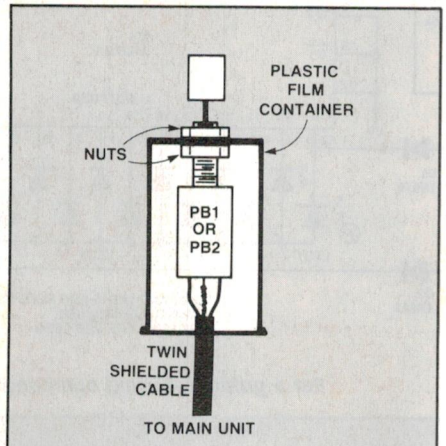


Figure 2. Assembly details for the players' hand controls.

Check the orientation of the two capacitors, the diodes and ICs. IC sockets are not required unless you are dubious about soldering the ICs directly.

The tricky part of construction is mounting the LEDs. Each LED needs to be oriented correctly and its leads bent over 90 degrees about 5 mm from the base. These can then be positioned and soldered to sit approximately 8 mm off the pc board (see Figure 1 and the photos). If you're adding the options, now's the time to do it. Watch component orientation (check with the component overlay).

Drill the holes required in the front panel and sides of the zippy box. Mark out the positions carefully and centre-punch them before drilling. Clean off any burrs afterwards.

To stick the Scotchcal label onto the front panel, use the following technique. Firstly, spray paint the panel with white paint to prevent any imperfections in the aluminium from showing through the thin plastic Scotchcal material. Put it aside to dry. Next, peel the paper backing off the Scotchcal label and soak the label in water. Scotchcal, and most contact-stick plastics, become less tacky when wet and this allows them to be handled much more easily. Also soak the painted panel (after it has dried!) and apply the label to it.

You'll notice that, as long as both surfaces are wet, it's possible to slide the label around until it is correctly positioned (applying dry Scotchcal gives you only *one chance* to get it right — usually you

PARTS LIST — ETI-807

Resistors.....all ¼ W, 5% unless noted
R1-R7, R11*.....15k
R8.....470R
R9.....220R
R10*.....27k
R12*.....5k6
R13*.....270k
R14*.....120k
R15.....(see text), 1 W

Capacitors
C1*.....1µ/16 V pc-mount electro
C2.....220µ/25 V

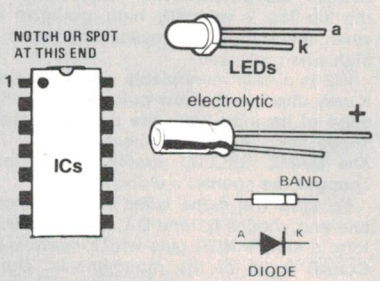
Semiconductors
IC1.....74LS74
IC2.....74LS123
IC3.....74LS193
IC4.....74LS154 or 74154
IC5*.....74LS86
IC6*.....555 timer
D1, D2.....1N914, 1N4148
LED1, LED15.....5 mm flashing LED (optional; otherwise as for LED2 etc.)
LED2-LED7, LED9-LED14.....5 mm red LED
LED8.....5 mm green LED
ZD1.....5V1, 1 W zener (see text)

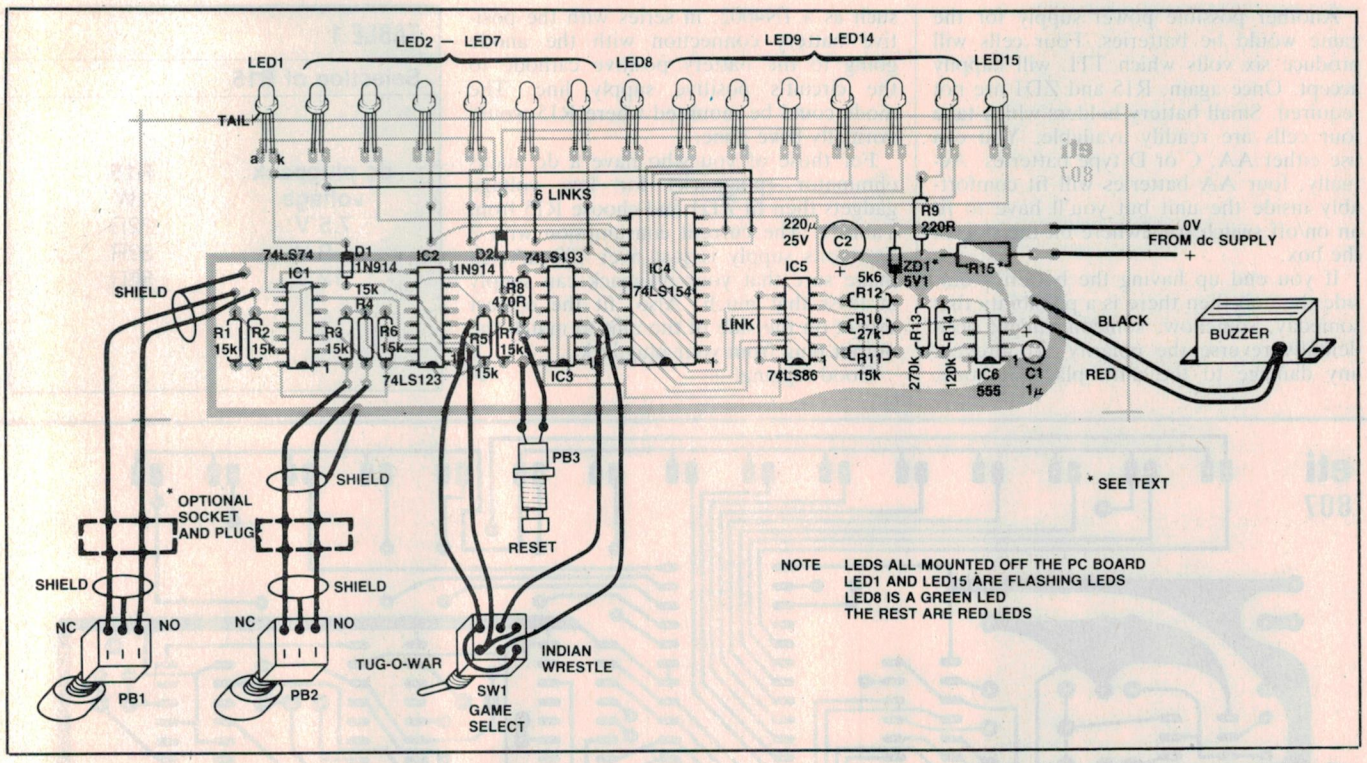
Miscellaneous
PB1, PB2.....SPDT momentary-action pushbutton switch (or DPDT type, e.g: Dick Smith cat. no. S-1220).
PB3.....SPST momentary-action pushbutton (e.g: Dick Smith S-1102).
SW1.....DPDT ultra-miniature toggle switch (e.g: Dick Smith S-1245), if required.

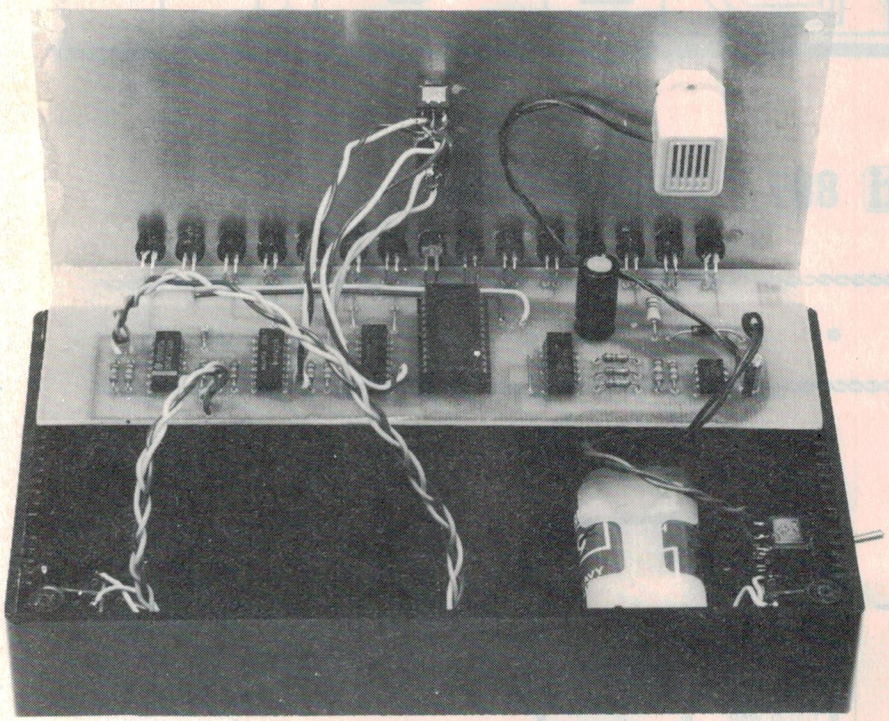
ETI-807 pc board; 60x113x196 mm zippy box; Scotchcal label; buzzer* (e.g: Dick Smith L-7009); two stereo 3.5 mm jack plugs and sockets (optional); 4xAA battery holder; dc power socket if mains eliminator is used (see text) fifteen LED bezels; hookup wire; two metres of twin-shielded cable; nuts, bolts, film containers, etc.

Price estimate: $30-$40
(depending on options)

*** Parts marked with * only required if sound option is fitted.**







Inside-out. Showing the general assembly. The box I used features 'slots' down the sides and the pc board slips into these. The battery holder visible here was held in place with double-sided sticky pad.

miss!!). Then wipe the label with a piece of cloth to squeeze out excess water and wait until the whole assembly is dry. Hey Presto! One correctly attached label.

Now insert the LED bezels and push all the LEDs through. The two front panel switches should be mounted next and wired to the pc board. Use washers beneath the nuts to save tearing the Scotchcal label.

The players' hand controls can now be made. Any type of container can be used; for example a small zippy box. For the prototype, I used two plastic film containers. I cut a hole in the bottom of each container and mounted the pushbutton switch, as shown in Figure 2, after soldering the connecting cable to the contacts. A small hole in what used to be the film container's lid enables the shielded cable to exit. The other end of the cable can be terminated with a 3.5 mm stereo plug which plugs into a 3.5 mm socket on either side of the main unit or, to cut costs, simply connect it directly to the pc board, passing the cable through a hole drilled in the side of the box.

If a dc plugpack is to be used to power the unit (see later), then the corresponding socket can be mounted in the side of the box and wired up.

The buzzer, if used, can be mounted in any convenient position, either inside or outside the box.

Powering up

Once constructed, the unit will run from a variety of power sources. The ICs used in the game are TTL types and this immediately specifies +5 volts as the required supply. If you have a simple 5 V dc power supply available then the problem is solved. In this case, resistor R15 and zener ZD1 are not required and simply wire your supply to where the zener would have been. IMPORTANT — ensure that the supply is connected the right way round, otherwise *all* the ICs will be destroyed. ▶

Another possible power supply for the game would be batteries. Four cells will produce six volts which TTL will happily accept. Once again, R15 and ZD1 are not required. Small battery holders which take four cells are readily available. You can use either AA, C or D type batteries. Actually, four AA batteries will fit comfortably inside the unit but you'll have to fit an on/off switch somewhere on the side of the box.

If you end up having the batteries outside the unit then there is a possibility that someday, somehow, someone might accidentally reverse the polarity. To prevent any damage to the unit, place a diode, such as a 1N4002, in series with the positive battery connection with the anode going to the battery positive cathode to the circuit's positive supply line. The diode could be mounted where R15 would normally have gone.

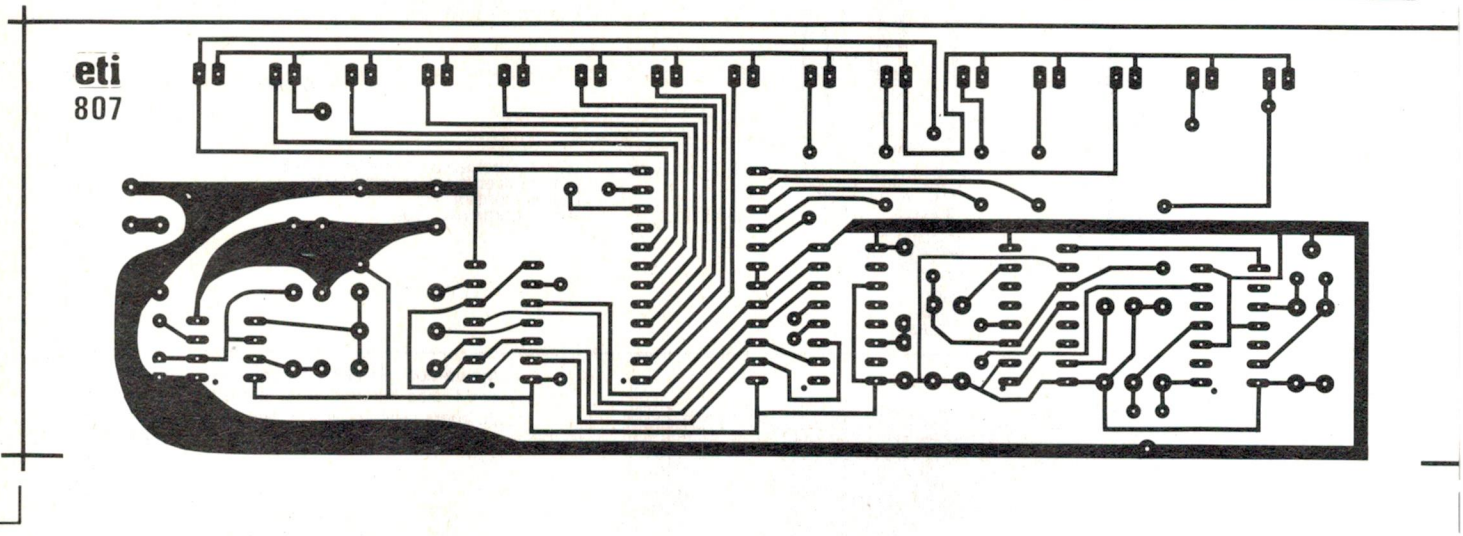
For those of you who have a dc mains eliminator (plugpack) for low voltage gadgets then fit ZD1 and choose R15 from Table 1. The current consumption with a five volts supply is just over 100 mA, so make sure that your plugpack can supply at least that much. Also, fit the correct socket on the side of the unit to match the output plug from your plugpack.

Good tugging! ●

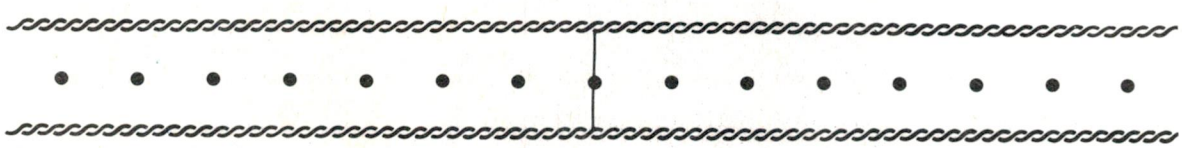
TABLE 1

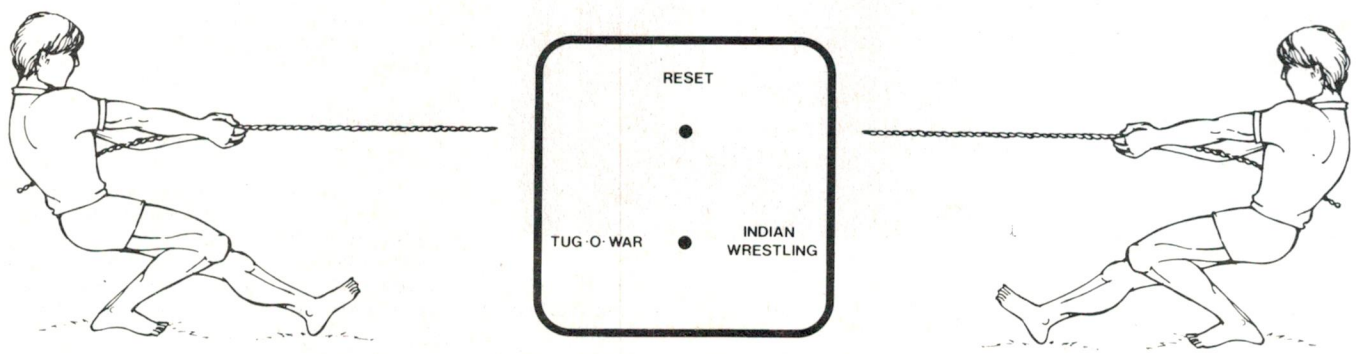
Selection of R15

dc plugpack voltage	R15 1W
7.5 V	22R
9 V	33R
12 V	56R



eti 807 TUG·O·WAR





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100k

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SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R 20R 50R 100R 200R 500R 1K 2K 5K 10K 20K 50K 100K 200K 500K 1M 2M

1–9	10–99	100+
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Values may be mixed

Hexadecimal Keypad

$42.50

19 key pad includes 1 10 keys A B C D E F and 2 optional keys and a shift key

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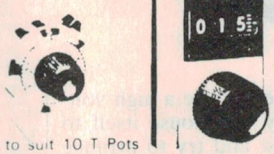

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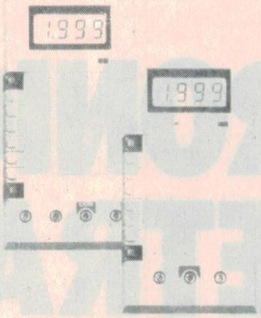

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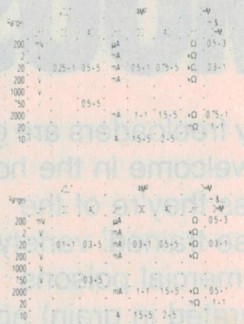

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Q17040 specifications

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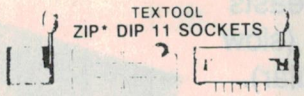

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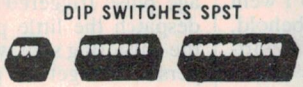
SD6	6	$2.30
SD7	7	$2.40
SD8	8	$2.50
SD10	10	$3.00

DIP SWITCHES SPST



cermet single TURN TRIM POT

Spectrol model 63P ACTUAL SIZE

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Values may be mixed

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HS2 — 75mm	3 00	2 90	2 50	2 00	2 00	1 50
HS3 — 150mm	5 80	5 40	4 90	3 80	2 90	2 70
HS4 — 225mm	8 10	7 60	7 10	5 90	4 50	4 30
HS5 — 300mm	8 90	8 40	7 90	6 50	4 90	4 60

Unanodised

HS11 — 38mm	1 40	1 20	1 00	0 90	0 80	0 70
HS12 — 75mm	2 50	2 20	1 90	1 60	1 25	1 20
HS13 — 150mm	4 90	4 50	4 00	3 20	2 45	2 40

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DE 9C	9 PIN COVER	2.55	2.45
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ELECTRONIC MOUSETRAP

With Auto Despatch and Reset

Ian Thomas

Furry freeloaders are generally not welcome in the home unless they're of the 'house-trained' variety. Commercial poisons (saturated in grain) act as an anti-coagulant and the beasts die by bleeding to death (slow and aesthetically unpopular). Other methods maim or kill slowly. This electronic mousetrap despatches them in milliseconds and automatically resets!

RECENTLY, relatives of mine reported that they had acquired some tiny furry freeloaders and couldn't find a mousetrap anywhere. This seemed a bit strange so I went to try and get some myself. Lo and behold, they were right — the mouse plague reportedly invading our three eastern states seemed to have taken all available supplies. I must have tried at least ten shops in both my local shopping centre and in the big smoke but there wasn't one mousetrap to be bought. OK then, perhaps it would be an idea to build my own. At least if the design turned out to be better, then I'd get a new path to my front door on the insurance!*

Given that the mousetrap was to be electronic (what else for an electronics engineer?), the first question was exactly how to despatch the miniscule marauders without a risk of doing the same to me. Suggestions from Roger for robot arms with hammers in their claws seemed a little too 'high tech' for me and perhaps not quite practical (I never suggested that . . . Ed). The easiest way seemed to be a simple *ZAP* at just the right time and place.

The simplest way to do this would be to take the mains lead, connect the neutral to a metal plate and the active to an insulated bolt in the centre of the plate with some cheese on the bolt. It would probably work just fine but would also probably clean up all the pets and small children in the area too! Things should be simple, but not *too* simple — to paraphrase Einstein.

The best idea seemed to use a high voltage pulse triggered by the mouse itself to despatch the little pest and try to arrange the triggering so it would be very hard for a person to get a potentially lethal belt through any part of their anatomy.

If the object of the exercise is to electrocute the rodents then it seemed a good idea, working on the "more is better" principle, to poke as much power as possible into the mouse. Clearly then, if we want to achieve optimum power transfer into the mouse then it is necessary to arrange for the output impedance of the high voltage generator to be the complex conjugate (opposite) of the mouse input impedance or:

$$Z_{out} = Z_{mouse}$$

where

$$Z_{mouse} = R_{mouse} + jX_{mouse}$$

and therefore

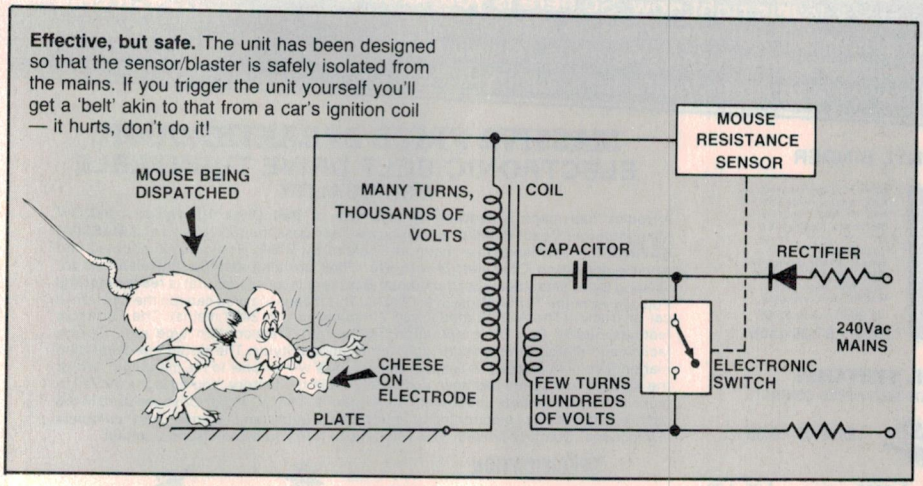
$$Z_{out} = R_{mouse} - jX_{mouse}$$

About this stage I started to get the feeling that technical niceties were starting to get the better of things (besides which, have you ever considered how to measure the complex input impedance of a mouse? Awkward to say the least!). Since it's a well known tenet that ". . . it's the volts that jolts but the mils that kills," I decided on generating one massive pulse of high voltage with a reasonably low output impedance to do the deed.

Generating this sort of high voltage pulse has been done for years now (perhaps in a rather extreme form). Capacitor discharge ignition systems in cars are a case in point. They are well understood, so I decided to use a similar method in my mouse-macerator.

The method requires that a capacitor be charged to a high dc voltage and then dumped into a coil which acts both as an inductance and a step-up transormer. The output voltage of the whole assemblage is equal to the capacitor dc voltage times the coil step-up turns ratio. Normal CDI systems deliver about 30 to 40 kV, *far* too much for this application. These voltages are hard to contain and tend to flash over everywhere. Also, the high step-up turns ratio in an automotive coil (usually about 100:1) means an equal step-down in current, all else being equal, which we don't want.

* On the theory that "build a better mousetrap and the world will beat a path to your door".



Effective, but safe. The unit has been designed so that the sensor/blaster is safely isolated from the mains. If you trigger the unit yourself you'll get a 'belt' akin to that from a car's ignition coil — it hurts, don't do it!

Design details

If we assume that the mousetrap will be mains powered then a simple diode and resistor combination will charge the storage capacitor to about 340 volts if left to itself and, with a 1M resistive bleed, it drops to about 280 V. This is still heaps (we want to terminate them — not blow them to pieces) and if the capacitor is followed by a 20:1 step-up coil the output voltage becomes about 6 kV — just nice!

The actual mechanism of the trap requires that the voltage not be continuously maintained but pulsed when the victim is nibbling on the bait. Even the most credulous mouse would probably be a bit wary of cheese that glows blue in the dark, buzzes and crackles a lot and stinks of ozone (although I have known limburgers with such characteristics!). This means that the sensing mechanism that detects the presence of the victim must also be able to tolerate 6 kV pulses. Another major problem to be aware of is that the trap is running off the mains and the output *must* be isolated to avoid any unfortunate mishaps.

The actual layout for the trap is a central disk, on which the cheese is placed, surrounded by a wide earth mat. The theory is that when our furry foe approaches the bait his back paws will be on the earth and its nose or front paws will touch the central electrode. When the trap triggers, all the goodness stored in the capacitor will flow through the whole body of the mouse causing instant discorporation and, hopefully, throwing it away from the trap ready for the next candidate for the big cheese factory in the sky. (See? — auto despatch and reset!).

The easiest way to isolate the trigger circuit from the output pulses is to use a large series resistor and in the actual design I used the largest I could get, namely 22M. Experimenting with a DVM I found that normal body resistance of a person (me) is of the order of 1M, most of which is skin resistance. The resistance of the interior of a body is very low as it's mostly salt water so I reasoned that a mouse would probably be about the same for the worst case and, if its mouth was actually on the cheese, probably a bit less. Therefore, compared to the 22M resistor, the mouse could be regarded as a short circuit.

The secondary winding of the coil is connected directly to the central electrode. To prevent it shorting out the resistance of the mouse the other end of the secondary is connected to two diodes which are reverse-biased by the trigger power supply. This nicely leaves the whole secondary floating when it has no voltage across it, but when the trap triggers one of the diodes will turn on and clamp the end of the coil effectively to earth (or +12 Volts which, compared to 6 kV, is the same thing) giving the mouse the full benefit of the voltage excursion.

As the secondary is *very* well insulated from everything else (it has to be to prevent flashover or punch-through), this arrangement ensures that mains voltages are completely isolated from the business end of the trap.

To further ensure that no mains could ever get near the output I powered the trigger circuit from a small transformer, even though only a few milliamps are needed, and coupled the trigger circuit to the dump SCR through an optocoupler. This nicely leaves the mains, dump capacitor and coil primary as the only parts of the trap that are connected directly to the 240 V mains.

The trigger circuit is a simple two-transistor amplifier with positive feedback around it to turn it into a monostable pulse generator. The most current that can flow through the 22M resistor is about ½μA so two transistors are needed to give sufficient gain to trigger the optocoupler. The optocoupler itself is a Motorola MOC3021 which has a triac type output and is normally used in triac power control circuits but it works just fine triggering SCR's too.

The dump capacitor is charged through two 220K resistors and a diode directly connected across the 240 Vac. Two resistors are used because there is no way of being sure which mains input is active and which is neutral. Using a resistor from each input ensures that, no matter how it's connected, a hapless project builder won't hang himself directly across 240 V when testing things out — he'll at least have 200k to ease the pain!

The coil primary has a diode across it so that after the SCR fires and dumps the capacitor's stored energy into the coil the diode turns on and prevents the coil-capacitor ringing and transferring the energy back into the capacitor again (see "How It Works"). The diode *must* be a rapid recovery type as things happen pretty fast when the SCR fires and 1N4006s are nowhwere near quick enough. Leaving the diode out reduces the effectiveness of the ZAP dramatically and without it I doubt that the pulse would do more than seriously annoy the mouse (and we don't want to annoy the mice do we?).

The coil itself posed me a few problems as I detest sitting for hours winding fine wire on formers and trying not to either drop it and have to start again or, worse, breaking the wire. For reasons I've already talked about, the coil has to have a 20:1 turns ratio so every turn on the primary means 20 more turns on the secondary. Clearly we want the fewest turns possible on the primary. *However* the coil primary must meet other requirements as well.

When the trap is triggered, the energy stored in the capacitor is transferred to the coil primary. Hanging just a few numbers around this we get:

$$\tfrac{1}{2} CV^2 = \tfrac{1}{2} LI^2$$

where V is the capacitor voltage and I is the peak coil current.

Rearranging things we get:

$$I = V\sqrt{\frac{C}{L}}$$

All this says is that, if the primary inductance is too small the peak current becomes impractically large. As this peak current has to flow through the SCR, and after that the clamping diode, the peak rating of these devices determines the smallest value inductor we can tolerate. As most diodes can tolerate high currents for microseconds I took the rating of the SCR as the determining value. This was given as 100 amps (no kidding — that's the peak current that flows!). Which, going through the numbers, gives an inductor value of about 20 microhenries. I did a bit of experimenting with various core materials and found that about twenty turns around a ferrite core gave the right value (see *Construction*) which gave me 400 turns of secondary to wind.

In the final coil these very high currents cause the core material to saturate which makes these values a bit dubious but the final thing still seems to work just fine!

The picture is actually a bit more complicated than these simple calculations show as current also flows in the secondary/mouse circuit which helps avoid the saturation problem. In order to ensure that saturation of the core doesn't cause problems I made sure that the coil would still work as a transformer by winding both the primary and secondary as simple, one-layer solenoids ▶

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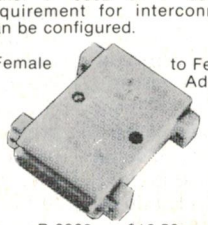

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- ★ Platter Diameter 280 mm.
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- ★ Pick up Arm Counter balanced type with cueing facility.
- ★ Pick-up ceramic stereo with diamond stylus.
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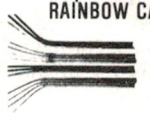

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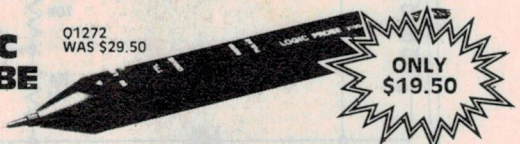

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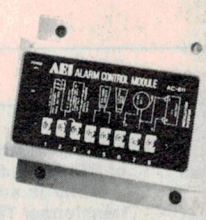

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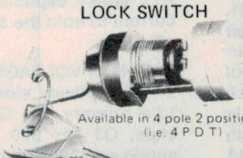

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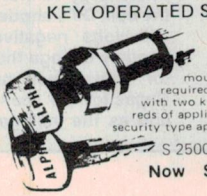

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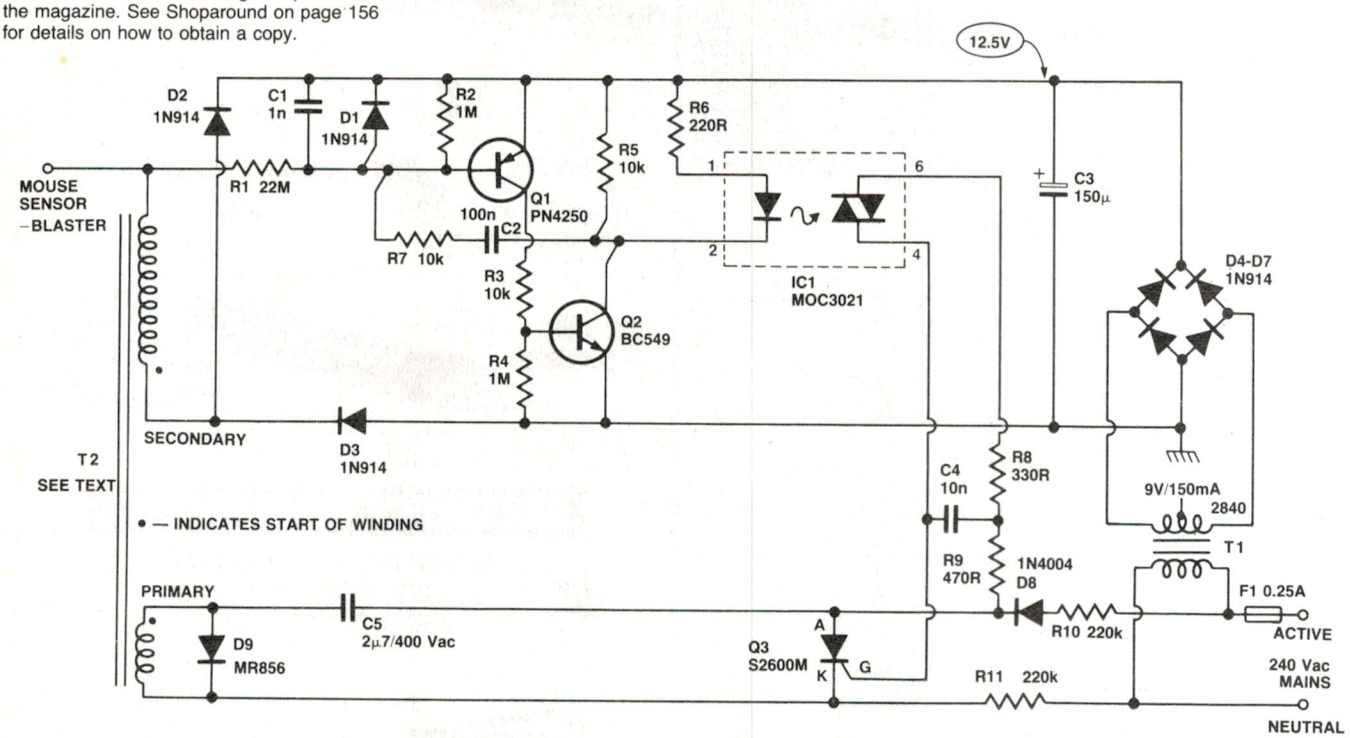
N/C denotes normally closed contacts when magnet in proximity of switch.

N/O denotes normally open contacts when magnet in proximity of switch.

NOTE: The artwork is too big to reproduce in the magazine. See Shoparound on page 156 for details on how to obtain a copy.



HOW IT WORKS — ETI-1524

The mousetrap can be divided into three sections which are:

1. The sensing circuit
2. The trigger circuit
3. The high voltage pulse generator

THE SENSING CIRCUIT consists of the two transistors, Q1 and Q2, with their associated components. One end of R1, the 22M resistor, is connected to the trap centre electrode and coil secondary winding. The other end of the coil secondary is connected to the two diodes, D2 and D3. As the cathode of D2 is connected to the trigger positive rail (about +13 volts) and the anode of D3 is collected to ground, both diodes are reverse-biased and are effectively open circuit. This means that the electrode, when no mouse is near, is at the positive rail potential and no current flows through R1. Q1 is held off by R2 which in turn leaves Q2 off also as no collector current flows from Q1.

When a mouse makes contact with the centre electrode its body resistance to ground causes the electrode to go to ground potential and about 0.5µA to flow through R1. Resistors R1 and R2 form a potential divider such that for mouse body resistances greater than about 2M, Q1 will not be turned on, but for lower resistances, Q1 is turned on which then turns on Q2. Positive feedback is applied through R7 and C2 to then turn both transistors hard on and provide about 50 mA of current through the LED side of the optocoupler, IC1. After about a millisecond, C2 is discharged and removes the heavy drive from Q1's base causing it to turn off again.

The base of Q1 has a diode, D1, to the positive rail so voltage transients from the trap firing are clamped and do not destroy the transistor (R1 ensures that only about 0.25 mA can flow). Capacitor C1 forms a low pass filter with R1 to stop capacitive coupling of RF pickup from falsely triggering the trap.

Power is suplied to the trigger circuit via transformer TR1 and the fullwave rectifier D4 to D7. Capacitor C3 filters the dc and gives a stable supply.

THE TRIGGER CIRCUIT is formed by the optocoupler IC1, the SCR, Q3 and their associated components. When the sensing circuit fires a trigger current flows through the LED side of the optocoupler IC1. This causes the output triac side of the optocoupler to go low impedance. Before the circuit is triggered, C5 is charged to about 300 volts through D8, R10 and R11. This also gives 300 volts across the SCR, Q3, and the optocoupler output triac. After the optocoupler is triggered the end of R8 is connected to the gate of theSCR, Q3. This causes gate currents of almost an amp to flow and turn on the SCR. Resistors R8 and R9 limit the current that can flow through the optocoupler and C4 ensures that the optocoupler never sees an excessively fast change in voltage ($\frac{dV}{dt}$). After the dump cycle is complete resistors R10 and R11 aren't capable of providing sufficient current to hold the SCR on so it returns to the off state.

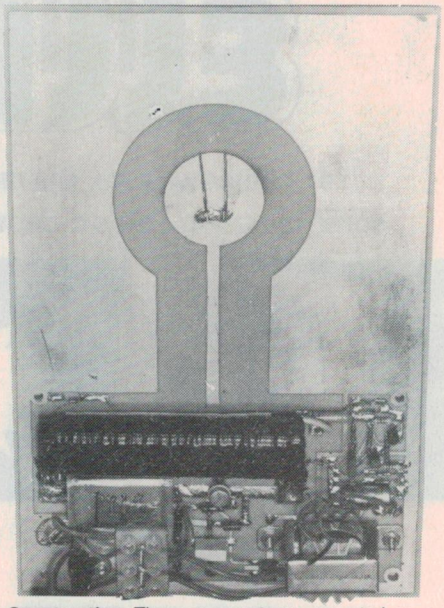
THE HIGH VOLTAGE PULSE GENERATOR is the deceptively simple circuit consisting of T2's primary, C5, Q3 and D9. In the steady state, Q3 has 300 volts across it with the anode positive and there is no voltage across T2 and D9. After the trigger, Q3, goes short circuit, and as there was 300 volts across C5, this energy cannot disappear so the node of the coil, D9's anode and C5 immediately goes 300 volts negative (in order to instantaneously change the voltage across a capacitor you must provide infinite current). Capacitor C5 then discharges through T2, and as the voltage across C5 decays (as a cosine function), the current through T2 rises as a sine function. At this time D9 is reverse biased.

This process continues until all the energy has been removed from C5 and its voltage swings to −0.7 volts, the on state voltage of D9. At this instant, peak current is flowing in T2's primary of about 100 amps if the secondary winding is open circuit. However, as there must have been a resistance across the secondary to trigger the trap, some of this primary current is transferred to the secondary. As the turns ratio of the transformer is 10:1 it takes 20 amps of primary current to produce 1 amp of secondary current.

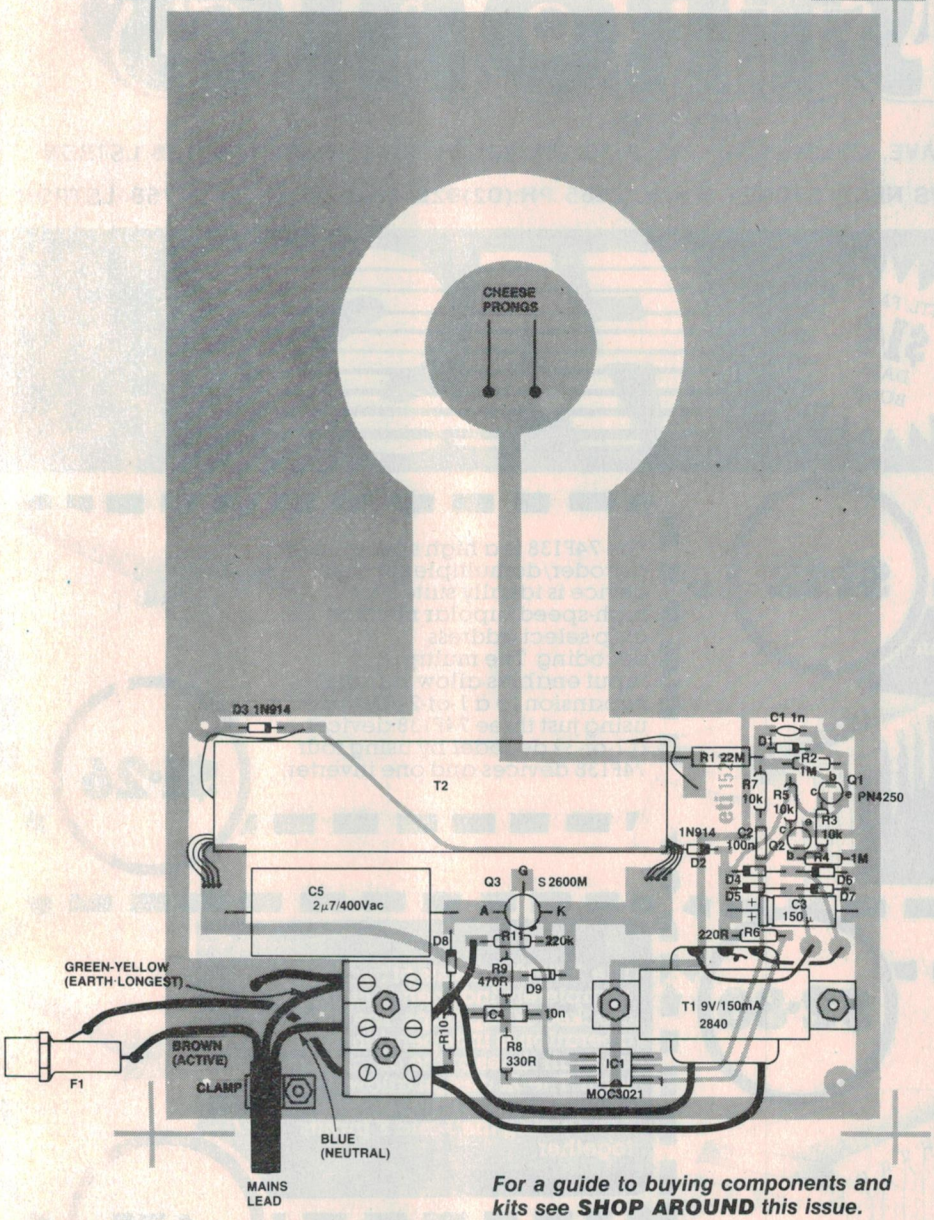
When the SCR first fires, the full 300 volts is imposed across the primary. As there is probably a secondary load of greater than a megohm (this is the resistance required to trigger the trap) the full 6 kV is imposed across the load mouse. This high voltage should cause the high skin resistance to break down and considerably lower the resistance presented by the victim. Thus, as the primary current runs up, the current in the secondary should run up also and take some of the load from the SCR (just how much of this actually occurs is hard to say as I didn't have a mouse to try it on and I didn't want to buy trouble with the RSPCA).

After the capacitor has completely discharged and peak current has been reached in both the primary and the mouse, diode D9 turns on and shorts the coil primary. This prevents the coil/capacitor (C5) combination from ringing and prevents the established peak currents to continue to flow until they run down exponentially.

Once the currents have completely decayed, D9 turns off and, as Q3 turned off when D9 turned on, capacitor C5 can commence recharging through D8, R10 and R11, completing the cycle.



Construction. The components are mounted on the copper side of the board, note. Two stiff wires soldered to the sensor/blaster pad hold the cheese. Four stick-on feet are attached beneath the board.



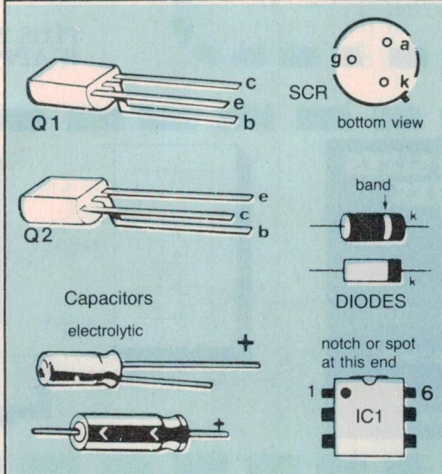
*For a guide to buying components and kits see **SHOP AROUND** this issue.*

which would be close-coupled even without the core. The choice of ferrite as a core material was made purely because it is readily available; transformer iron would be much better and if you can get some, use it by all means.

To make the mousetrap easy and safe to build I chose to use a rather unusual construction method where the components are mounted on the same side as the copper. This enabled me to use only one board and at the same time keep all the nasty bitey voltages safely enclosed. It's a bit more tedious to assemble but means the final trap is cheaper to make. A plastic jiffy box covers all the works and gives the project a nice neat appearance.

Construction

The first and most tedious part of building the mousetrap is to wind the coil. First the core material must be prepared. I used a



PARTS LIST — ETI-1524

Resistors ..... all ½W, 5% unless noted
- R1 ..... 22M, 10% ½W or 1W Philips CR50 or similar
- R2, R4 ..... 1M
- R3, 5, 7 ..... 10k
- R6 ..... 220R
- R8 ..... 330R
- R9 ..... 470R
- R10, R11 ..... 220k

Semiconductors
- D1-7 ..... 1N914, 1N4148
- D8 ..... 1N4004
- D9 ..... MR856 fast recovery diode
- IC1 ..... MOC3021
- Q1 ..... PN4250
- Q2 ..... BC549, BC109
- Q3 ..... S2600M (RCA) SCR, or C122E, TIC126E

Capacitors
- C1 ..... 1n disc ceramic
- C2 ..... 100n metallised poly
- C3 ..... 150µ/16 V axial electro.
- C4 ..... 10n/400 V (250 Vac) mains-rated metal foil plastic cap.
- C5 ..... 2µ7/400 V (250 Vac) mains-rated metallised cap (Siemens, type B32231 or similar self-healing type)

Transformers
- T1 ..... 240 V/9 V — ct, Dick Smith 2840 or similar
- T2 ..... see text

Miscellaneous

ETI-1524 pc board; 'UB-1' zippy box (157 x 95 x 50 mm); cable clamp; fuseholder; F1 — 0.25 amp 3AG fuse; mains cable and 3-pin plug, 3-way terminal block; Ferrite aerial rod 9 x 194 mm (approx.), e.g: DSE L-1401; 7-8 metres of 1 mm diameter enamelled copper wire; 30-odd metres of 0.16 mm enamelled copper wire; insulation tape; glue (see text); nuts, bolts, etc.

Price estimate: $28-$30

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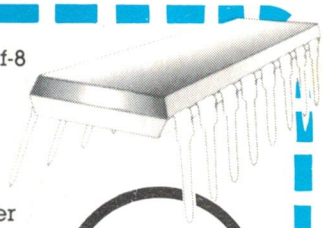
The 74F138 is a high speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three 74F138 devices or a 1-of-32 decoder by using four 74F138 devices and one inverter.



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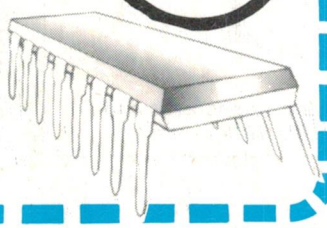
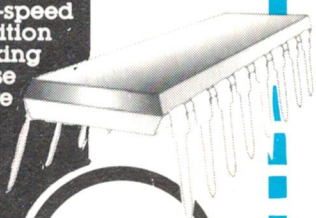
The 74F374 is a high speed, low power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A buffered Clock and Output Enable are common to all flip-flops.



The 74F109 consists of two high-speed completely independent transition clocked JK flip-flops. The clocking operation is independent of rise and fall times of the clock wave form. The JK design allows operation as a D flip-flop by connecting the J and K inputs together.



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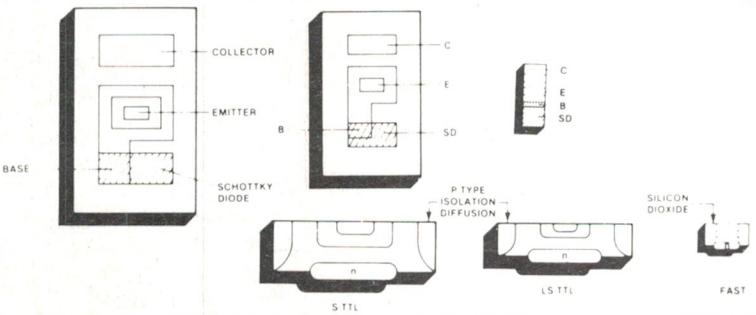

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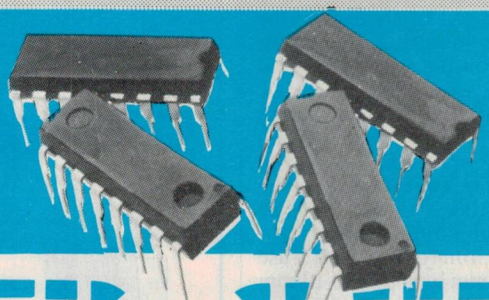

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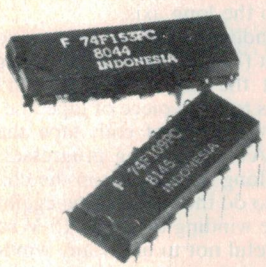

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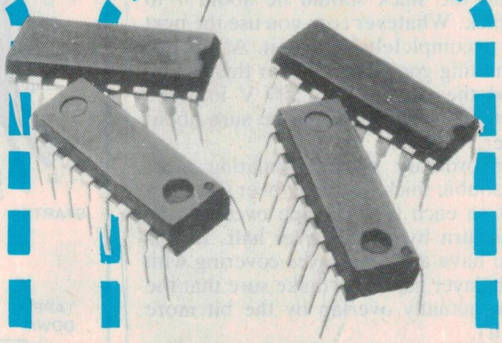

HIGHEST PERFORMANCE FAMILY OF THE 80s

Fairchild Advanced Schottky TTL, FAST, is a family of TTL circuits that exhibits a combination of performance and efficiency unapproached by any other TTL family. Made with the proven Isoplanar process, 54F/74F circuits offer the switching speed and output drive capability of Schottky TTL, with superior noise margins and only one-fourty the power consumption.

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ferrite rod stocked by Dick Smith (cat. no. L-1401) but, as mentioned, transformer iron would probably be better. If you want to stay with the ferrite it must first be cut in half. To do this, measure off *exactly* half way on the rod and score it with a three corner file. Score a nick all the way around the rod then, holding the rod firmly both sides of the score, tap the rod firmly against the edge of a table or somesuch so the rod is given a sharp blow on the score. It should break cleanly on the score.

Ferrite is very brittle stuff so don't smash it down — you'll break it into a trillion pieces. A firm rap is sufficient. Next, glue the two pieces together side by side to make a double thickness rod. Araldite or some form of superglue will do fine here.

If you want to use iron (or can get it!) use "I" laminations 100 mm long by 8 to 10 mm wide and the stack should be about 7 to 8 mm thick. Whatever core you use the next thing is to completely insulate it. As the primary winding goes directly over this insulation and the primary has 300 V imposed across it, it's a good idea to be sure about this layer.

Using ordinary plastic insulating tape, wind a double thickness layer over the core. Wind it so each turn of tape overlaps the previous turn by slightly over half. In this way you have a double layer covering with no single layer gaps (but make sure that the turns do actually overlap by the bit more than half).

The primary winding is the next to go on and consists of four parallel windings of 1 mm diameter wire (say, 18 B&S). You will need about five metres of wire cut into four equal lengths. Four parallel windings are used for two reasons. Very high currents flow in the windings and you want the power to go into the mouse, not copper losses, and also using four wires gives a nice flat surface to build the secondary winding on.

Make sure that the four wires are straight then, holding all four side by side, start winding them around the insulated core. As the wire is nice and thick there is no need to tape down the start end of the winding — when you bend it around the core it should stay put. Wind twenty turns on so they're exactly close spaced with no gaps whatever between the wires. It's important that the wires lie flat as a secondary must later be built up over this layer and bumps become a damn nuisance. Both ends of this winding should come out to the one side of the core so they can be terminated easily on the board. If your're using the ferrite core they should come out along the narrow axis of the core.

Next, using fine, long-nosed pliers, bend the four wires sharply so they protrude out the ends of the core (see diagram). It doesn't particularly matter if you damage the insulation as there isn't any voltage between the turns and its more important to keep the coil neat. Do both ends the same then wind another layer of insulating tape over the completed primary winding the same as you did for the core insulation. You'll have to hold the ends of the winding down when the layer of tape is wound on. Take the tape right over the ends of the core then trim them back flush with the core. It's very important that the primary be properly insulated as it's connected (through resistors, but still connected) to the mains and we'd prefer not to have you hurt yourself!

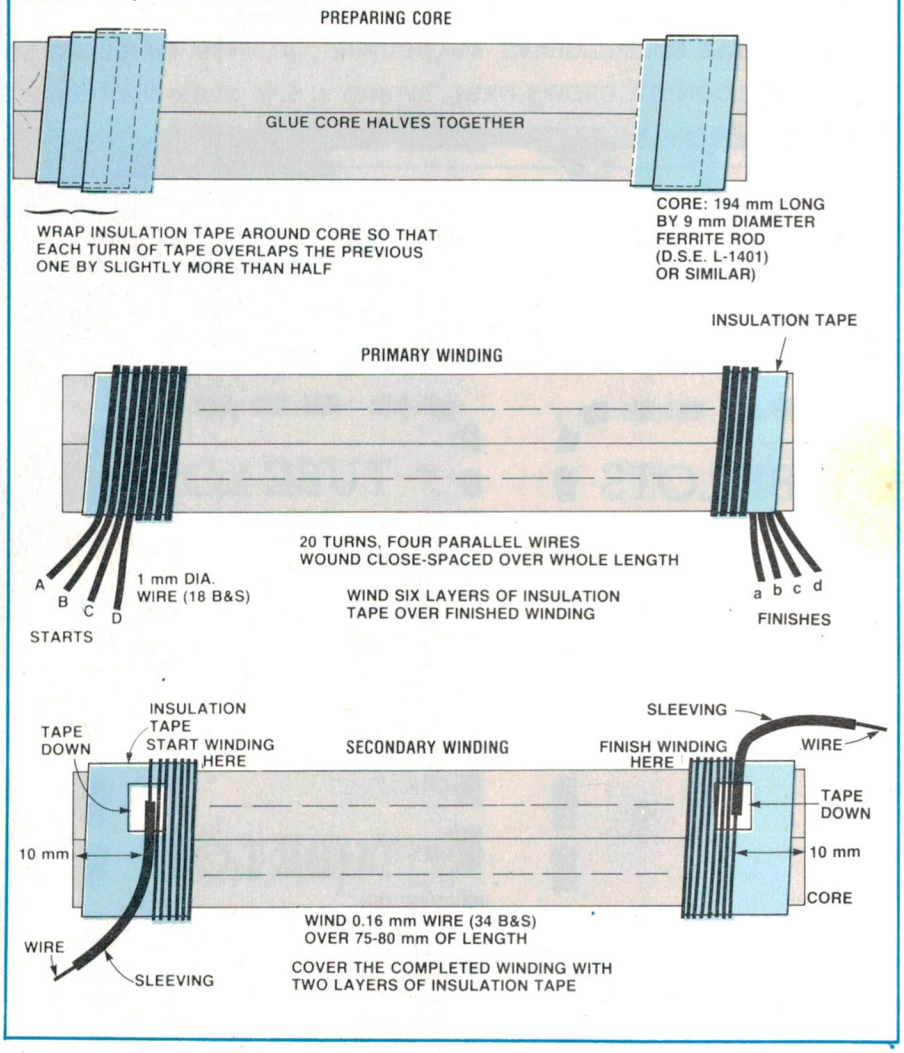
As most tapes can only be relied on for about 500 V, and the secondary goes directly over this covering, one double layer is nowhere near enough to insulate it. Wind on another *five* layers using the same technique, so each layer gives a double thickness of tape, and winding each layer so it spirals in the opposite direction to the layer under it. This makes for a great lump of a coil but ensures that no flashovers occur. Each layer of tape should be taken right over the ends of the coil then trimmed back.

Now comes the fun bit — winding the secondary. I used 0.16 mm (say, 34 B&S) diameter wire. It is entirely too easy to break, so be warned! You'll need about 30 metres of wire, which works out at about seven grams weight, unless my calculator is in error. To protect and insulate the ends of the wire, cut two pieces of silicone rubber sleeving about 50 mm long and slip one piece over the end of the wire so about 100 mm protrudes.

Then, using a piece of insulating tape 10 mm long, tape the start of the wire down on one end of the coil so the tape covers half sleeving and half bare wire. The wire should be 10 mm in from the end of the coil and perpendicular to the long axis.

Now start winding on the secondary so each turn is tight (not too tight!) and laying hard up against the turn before. A very good idea here is to cut a piece of tape and, as you wind 7 or 8 mm of coil, tape the winding down. As the winding progresses, move the tape along so if you drop the coil you don't have to do the whole thing again! Each turn of the winding develops 15 V so you must be careful not to allow any windings to overlay other turns — if you get a shorted turn the coil is absolutely useless.

The coil. Illustrating the steps in winding T2. Note that the secondary winding requires about 400 turns. Twenty turns either way doesn't matter.

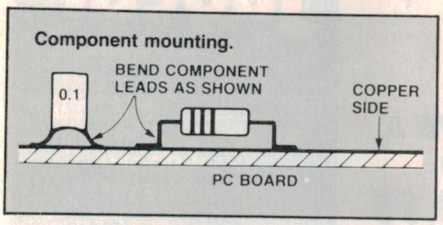


Keep on winding until you get to within 10 mm of the other end and you should have 75 to 80 mm of even, tight-spaced copper wire. If there are some narrow spaces between some of the windings it doesn't particularly matter but don't have too many — you're throwing away volts. Cut off the end of the wire so you have 100 mm of free end and slip the second piece of sleeving over it. Using another piece of tape terminate the free end the same as you did for the start. Then cover the whole secondary with a double layer tape winding and the coil is finished.

At this stage I checked out the coil in the following manner. Connect the 2.7 µF capacitor, used for C5 in the final circuit, in parallel with the coil primary and connect the two to your audio oscillator. Measure the ac volts across the parallel circuit and adjust the frequency until you find the resonance. For my coil it occurred at 19 kHz and was very sharp (3 dB down only a few hundred Herz either side of resonance. With the primary at resonance, measure the secondary voltage and you should find it 20 times the primary voltage. If you find the coil has a very poor Q you probably have a shorted turn somewhere so you'll have to find and fix it. I didn't try making an iron-cored coil so I can't give figures but I'd expect that the resonant frequency would be lower (maybe around 10 to 15 kHz) and the Q would probably be lower too due to iron losses.

The next step is to make the printed circuit board. If you've bought a kit, this is the easiest part as it's ready-made. But if not, use the layout given. As the components are not passed through holes in the board as normal, avoid using paper-phenolic board material as the copper tends to come off easily. Stick to the epoxy-glass-type where the copper bonding is better.

After you've made the board, assemble it according to the layout given. The compo-



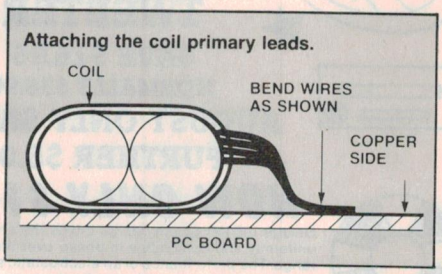
nent leads are formed by bending them down sharply as if you were going to solder them in a normal board with holes then, with pliers, bending the leads out flat again shown in the drawing above the component layout. Pre-tin all the pads that have components attached, then hold the components in place and solder them in. The power transformer centre tap is cut off short as it isn't needed. Use countersunk-head screws to mount the transformer and mains terminal block and mount them in place also. The two power transformer secondary leads go onto the two round pads.

Before attempting to mount the coil, it's necessary to form the primary leads. Hold the coil in place and carefully bend the primary wires so they come down sharply onto the board then lie flat against the copper pads. If the wires are bent one at a time they shouldn't give any trouble. When you've made sure that the wires are just right and the coil is located correctly, cut off the eight wires so they have 5 or 6 mm actually in contact with the board.

Before attempting to tin the cut ends, hold the coil so the ends of the wires are resting on the edge of a table and scrape away all the enamel insulation where you want the solder. This enables the solder to "take" quickly and doesn't let things get too hot. The plastic insulating tape in the coil is not at all tolerant to heat and if you let things get too hot when tinning the leads the coil may flash over in use. When actually tinning the ends be as quick as possible and try to cool them as soon as they're done. I used a pressure pack cold spray to freeze them after they were tinned.

Attach the coil to the board using double-sided adhesive foam strip. This can be bought from any hardware store and solder the primary leads to their pads. Trim back the silicone sleeving to the right length so the secondary leads lie neatly on their pads. Being careful not to damage the wires inside, tin the leads (no worry here about excess heat) and solder them to the board.

Cut and bare back the two mains leads from the mains transformer so there's a bit of slack when they're inserted into the terminal block. You only need 6 or 7 mm of bare wire and I won't labour the point about having bare wire protruding from the terminal block being dangerous. Use the pieces of wire you cut off the transformer to connect to the resistors R10 and R11. Bare the same amount of wire as you did for the transformer, twist the transformer leads together with the pieces of wire and connect them to the terminal block. Solder the other



ends of the pieces of wire to the pads on the board and assembly is almost complete.

Strip back the outer insulation of the mains flex for about 250 mm then cut off all three (if you only have two you've got the wrong sort of flex!) leads 120 mm from the end of the outer insulation. Cut the active lead to 100 mm and bare 10 mm of the end. Trim the neutral lead (blue) so it protrudes 50 mm from the cable's outer insulation. Bare the neutral and earth lead ends from 10 mm and clamp the flex to the board with a cable clamp.

Take the piece of earth lead you originally cut off and cut it to 50 mm long. Bare 10 mm of wire at each end. Twist the end of this piece together with the bared end of the earth lead from the flex and solder them together then clamp the soldered end *in the terminal that is NOT connected to the transformer*. Solder the other end of the earth lead that's protruding from the terminal block to the ground on the board, using lots of solder and make absolutely sure that it has properly taken. The graveyards are full of people who thought "Yeah! yeah! I'll fix the earth up later" so make *absolutely and positively sure* that you can trace the earth from the flex to the terminal block then out again directly to the ground on the board. When you're quite satisfied that all is well, connect the neutral from the flex to the terminal block so blue wire goes to blue wire.

Finally, cut a hole in the plastic jiffy box where you are going to mount the fuse holder and clamp it in place. Loop the bared end of the active (brown) lead through the end terminal of the fuse holder and solder it in place. Bare the ends of the spare piece of active lead you have and solder one end of the wire to the side terminal of the fuse holder and tape up both soldered joints as best you can (or slip on heatshrink tubing beforehand). Connect the other free end of the active lead from the fuse holder and the mousetrap is wired up. Attach a three-pin plug to the end of the flex, paying attention to the active and neutral pins on the plug, and you're ready to start testing.

Testing it

Testing is quite straightforward. Plug in the trap and turn it on with the jiffy box cover off to one side. Watch to see that nothing bursts into flames. Then, using your DVM, check that the trigger circuit power supply is in fact generating about 13 V. Next, check that the main dump capacitor, C5, has in fact fully charged to about 300 V. Measure the voltage between the anode of the SCR and either end of the coil primary (the anode of the SCR is the case). Bear in mind that the energy stored in the capacitor here is *dangerous*.

If all is well, you can try triggering the trap by touching the base of Q1 with your multimeter probe while the other probe is earthed. There should be a clear, audible click when it fires. The final test is to actually trigger the trap with a 1M resistor. Earth one end of the resistor (I used a lead with alligator clips on either end) then gently touch the centre electrode with the other end. Once again you should hear the click. If you increase the resistor to 2.2 megohms, the trap may or may not trigger and higher values don't work at all. As a final test, try triggering the trap with a 2k resistor. This is just the right impedance to get the full benefit of the trap. When it fires, it will blow the side out of the resistor! If you get a satisfactory "splat" and a destroyed, open-circuit resistor, all you need to do is screw on the lid, bait your trap (when it's off!) then go hunting mice. ●

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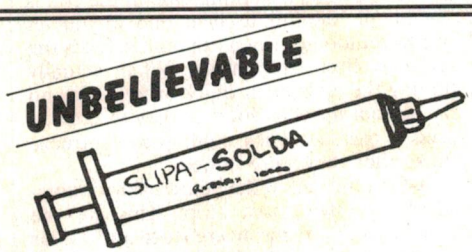

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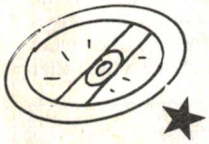

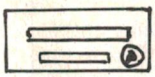

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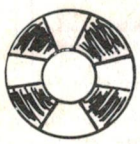

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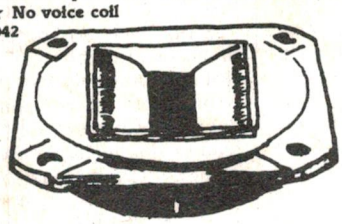

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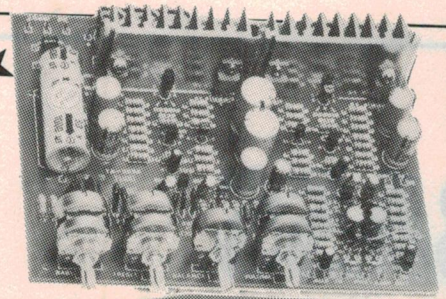

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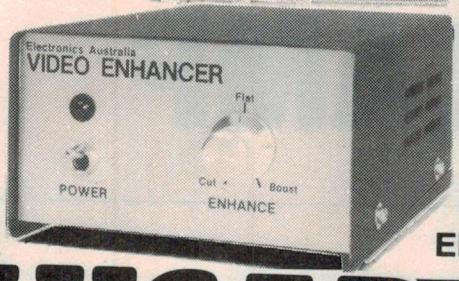
HB-5412	Black	$55.00	$52.50	132
HB-5414	Black	$59.95	$55.00	132



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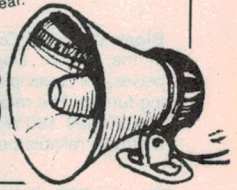

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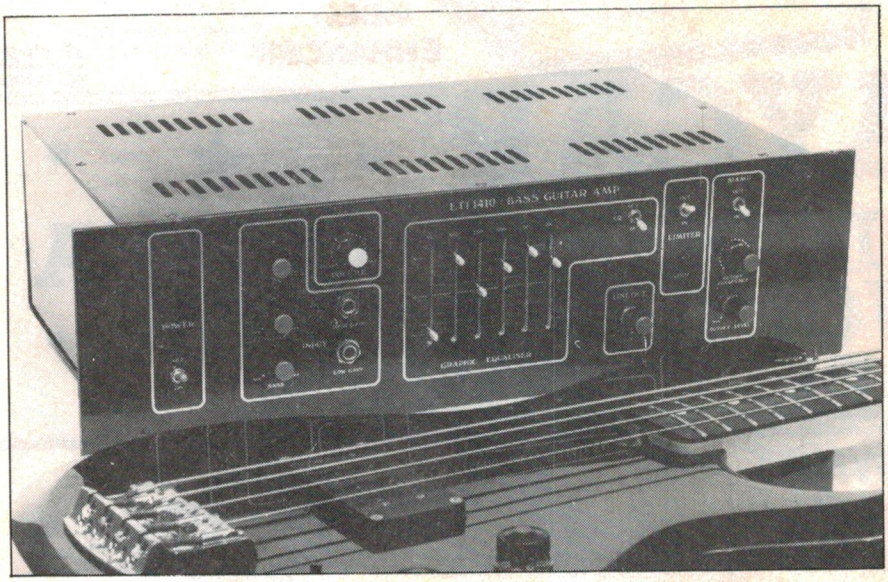
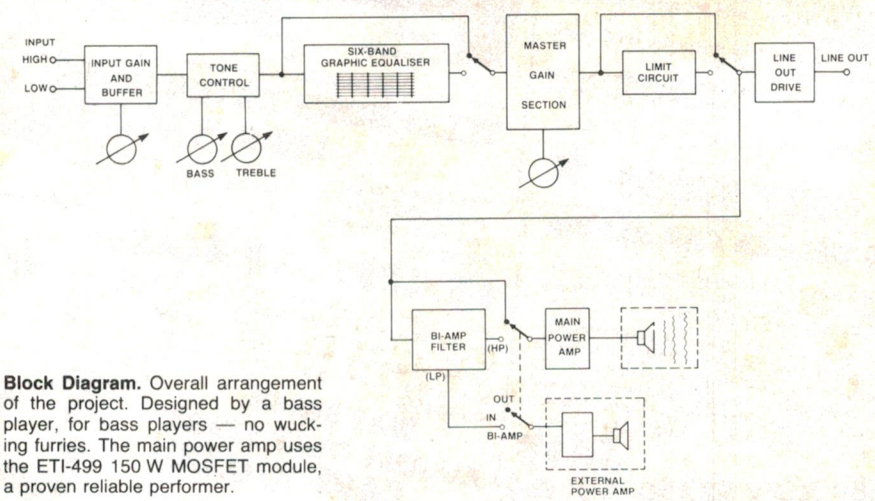


THERE HAVE BEEN many requests over the years from the growing numbers of build-it-yourself musicians for some good quality musical projects, particularly for stage amps of various descriptions. In the past, ETI has published some excellent power amp designs such as the old faithful '480 module, and in more recent times the '490 MOSFET module. Both of these amps are very suitable as the driver stage in a guitar or keyboard stage amp but, up until now, there have been no designs published for really suitable preamp stages to go with them. This has meant that these power modules have been primarily used in PA applications where they have been driven from a mixer or small mixing preamp.

This project describes a complete 150 W bass guitar amp using the ETI-499 MOSFET power amp module. The amp is housed in a standard 19″ rack-mount case which allows it to be dropped into a standard wooden road case or mounted in an amp rack. The preamp contains features ▶

FEATURES — ETI-1410 BASS GUITAR AMP

- 150 W RMS output into 4 ohms using the renowned ETI-499 MOSFET module
- High gain and low gain inputs
- 6-band graphic equaliser; 50, 100, 250, 500, 1k and 3k Hertz
- Line output facility
- Bi-amp facility
- Output limiter to avoid power amp overdrive
- Housed in a standard 19″ rack-mount case.



Block Diagram. Overall arrangement of the project. Designed by a bass player, for bass players — no wucking furries. The main power amp uses the ETI-499 150 W MOSFET module, a proven reliable performer.

HOW IT WORKS — ETI 1410

This article describes the design and construction of the preamp, equaliser, and 12 V power supply sections of the Bass Guitar Amp, so only these three items are covered here. The other sections are covered in Part 2.

ETI-1410a PREAMP

This is the input board. It comprises three main sections. IC3 is a 5534 op-amp configured as an inverting amplifier stage. The gain is dependent on which input is chosen. If the LOW GAIN input is chosen, then the gain is given by −R5/R3, which two for the values shown. If the HIGH GAIN input is chosen, then the gain is given by −R5/R4, which is −10 (i.e. ×10 inverted, for the values shown.

The gain of this stage may be altered by changing resistors R3, R4 or R5 and can be tailored to suit different input levels. It should be noted however, that if the gain is increased by any great amount (say, to 20), then it would require only a few hundred millivolts to saturate the input amp and drive it into clipping. Therefore, it is recommended that, unless the expected input signal is only a few hundred millivolts, the input stage gain should be left at unity. Also, the input resistance is set by the parallel combination of R1 and R3 for the LOW GAIN input, and R2/R4 for the HIGH GAIN input. These should be kept above about

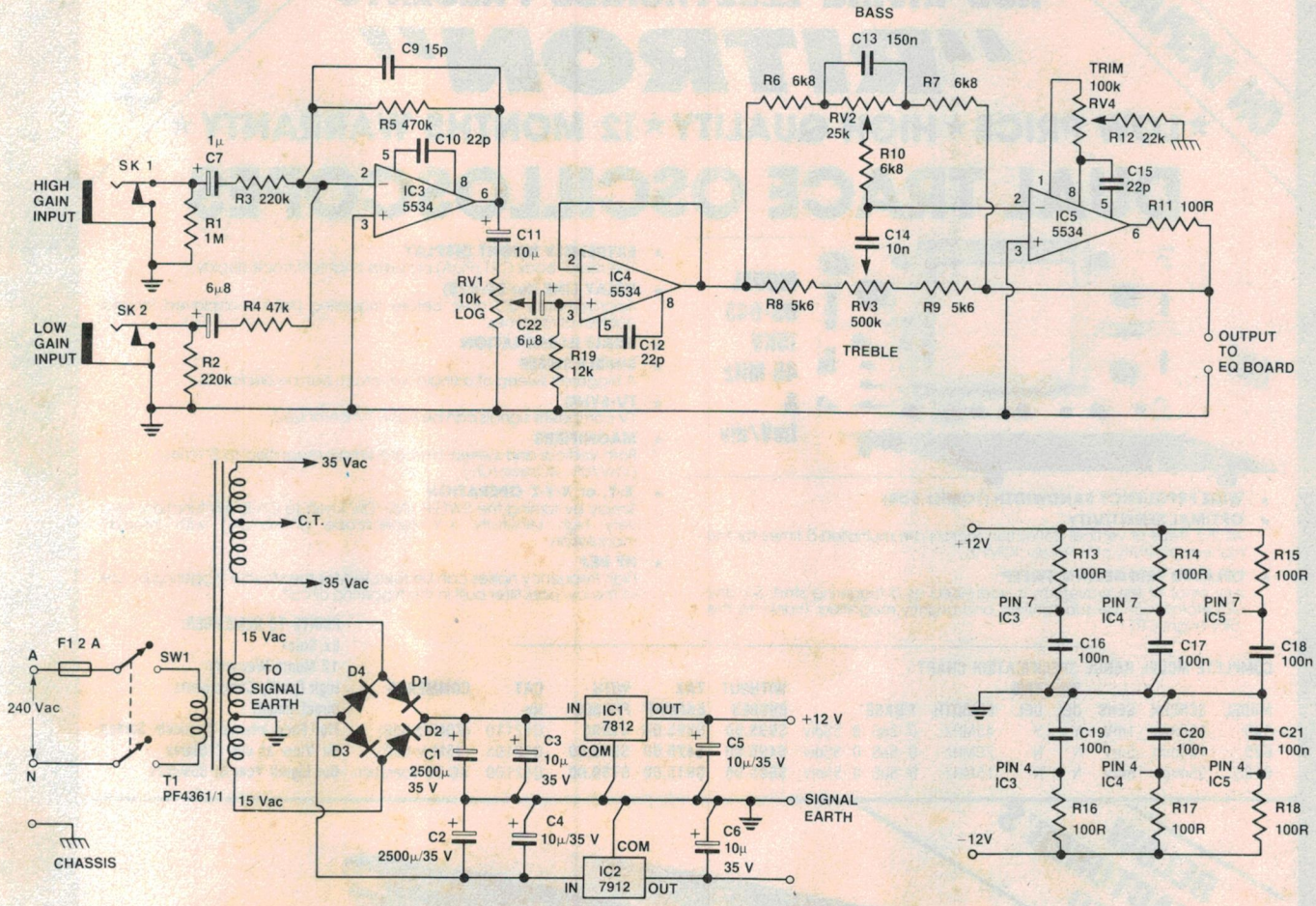


Figure 1. Tone control at low frequencies.

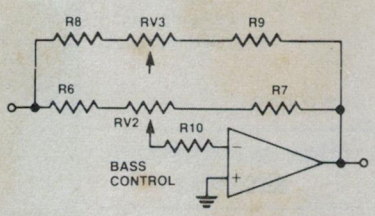


Figure 2. Tone control at high frequencies.

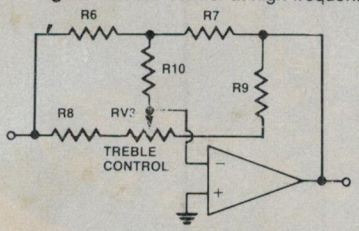
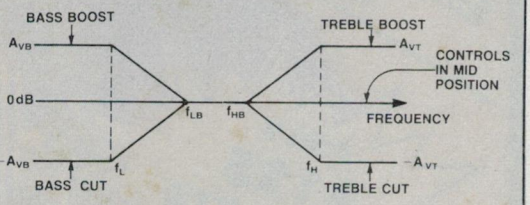


Figure 3. Bode plot of tone control circuit behaviour.



30k or so to give minimum loading to the bass pickups.

The input is ac-coupled via C7 or C8. Resistors R1 and R2 ensure that no charge can build up on the input line due to stray capacitances.

Capacitor C10 compensates IC3 at unity gain. Actually, the value used overcompensates the 5534, but since a very wide bandwidth is not essential in bass applications, it was decided to overcompensate for the greater stability it provides.

The output of IC3 is fed to IC4 via RV1 which provides signal level control. IC4 is a 5534 op-amp configured as a unity gain buffer. This isolates the input section from the tone control network and provides a low impedance drive for that network. Capacitor C12 provides the necessary compensation for IC4.

The tone control network itself is an active 'Baxandall' negative feedback type. Bass control is provided by RV2 and treble control by RV3. To see how it works, let us examine simplified circuits for the high and low frequency operation.

Figure 1 shows the simplified low frequency model. The capacitors become virtual open circuits at low frequency and the gain is dependent on the setting of RV2 only.

Figure 2 shows the equivalent high frequency circuit. This time, the capacitors become virtual short circuits and the gain is dependent on the setting of RV3 only.

The values for the tone control network were found using the equations for this type of circuit derived in the *National Audio Handbook*.

Figure 3 shows a Bode frequency plot for this circuit.

The circuit was designed for $A_{VB} = A_{VT} = 14$ dB, and $f_L = 40$ Hz, $f_{LB} = 200$ Hz, $f_{HB} = 600$ Hz and $f_h = 3$ kHz.

The op-amp used is, once again, a 5534. Capacitor C15 provides the compensation for unity gain operation. An offset null adjustment is provided via RV4 and R12. This allows cancellation of any dc offset at the output which could affect the bass control operation and generate noise.

ETI-1410b 12 V POWER SUPPLY

Referring to the circuit diagram, T1 has 15-0-15 Vac which is rectified by diodes D1 to D4. The two diode pairs provide positive and negative outputs which are filtered by capacitors C1 and C2, respectively. This yields two supplies of around +18 V and −18 V or so.

A three-terminal regulator, IC1, produces a regulated +12 V from the +18 V supply. Similarly, another three-terminal regulator, IC2, produces a −12 V output. Capacitors C3 to C6 are necessary for stable operations of the regulators.

The circuit diagram also shows the mains wiring, including the mains input fuse and neon bezel. These components are not mounted on the pc board and are covered in the general constructional details in Part 2.

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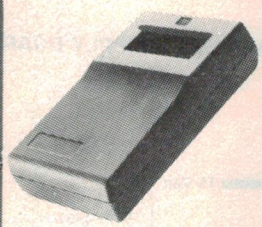

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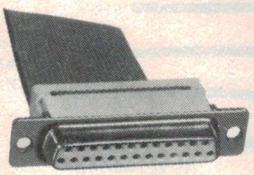

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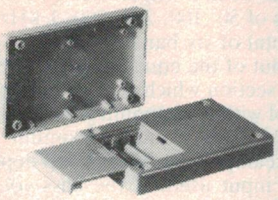

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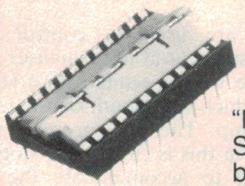

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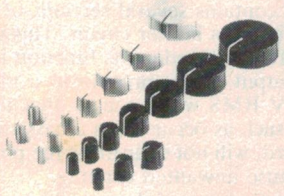

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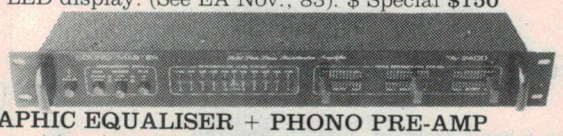

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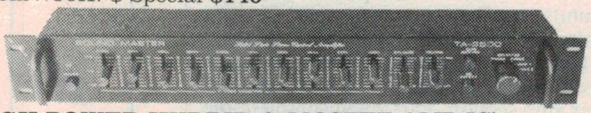

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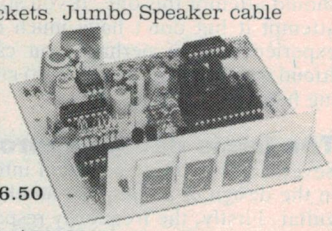

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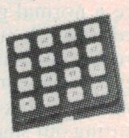

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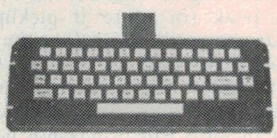

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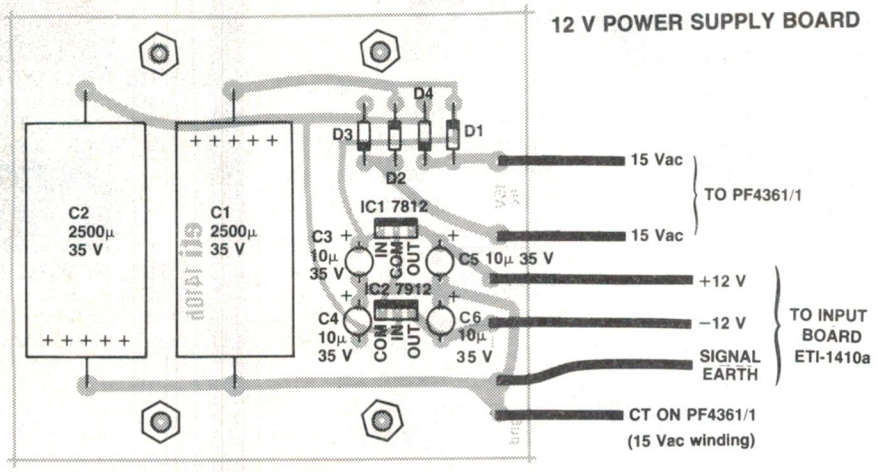
NOTE: Board artwork is reproduced on page 158.



such as 6-band graphics, limiter, line out and bi-amp facilities, which are usually found on only the more expensive commercial units.

This article details the overall concept and goes into the construction of the input board, the 12 V power supply and the power amp section. Part 2 will complete the project, giving details of the graphic equaliser and limiter/output boards and final assembly. Some options on setting up and using the amp will also be discussed.

It should be noted that, although far cheaper than a comparable commercial unit, this project would cost up to a few hundred dollars to build. Therefore, to avoid seeing some hard earned cash going up in smoke, only you folks with some experience in building electronic projects should attempt this one. If you still want to attempt it but don't have much electronic experience, then perhaps you can find a friend who does and is willing to give a helping hand to a starving muso.

The basic design approach

Several factors must be taken into account in the design of an amp for an electric bass guitar. Firstly, the frequency response. The low E string on a bass is usually tuned to 41 Hz. This means that the highest notes played on the bass will be only around three or four hundred hertz. As well as this, the average bass speaker box (a TL box for instance) will usually have an upper −3 dB cutoff frequency of around 1 kHz. With this in mind, it is important to design the bass and treble and equaliser sections to work in a suitable range. It's no good putting equalisation at 15 kHz since all you'll be equalising will be noise. Taking into account the need to be able to amplify harmonics as well as the fundamental of the notes it was decided to design the amp to work in the range 20 Hz to 5 kHz.

Unlike a normal guitar, a bass is usually amplified 'clean' (i.e: no clipping) and therefore it is important to ensure that there is plenty of "headroom" in the preamp stage. Most modern bass pickups are capable of putting out signal levels of a couple of volts peak (or more if pickups such as EMGs are used). Therefore the gain structure of the preamp should allow this level of input without causing clipping at the input stages. To facilitate the use of a bass with older pickups which may not have as high an output level, low gain and high gain inputs have been provided.

The power amp

The power amp used as the driver section for this amp is the ETI-499 150 W MOSFET power amp module described in the March 1982 issue of ETI. This module was chosen as it is very reliable, reasonably easy to construct and offers excellent performance and stability. The module will delivery 100 W into an 8 ohm load and 150 W into a 4 ohm load. All the components, including the power supply components, are mounted on the one pc board and the pc board mounts directly onto a heatsink.

The circuit of this amp module will not be reprinted in this article and, for the purposes of description, the power amp module will be treated as a 'black box'. For full details of the specifications and circuit of this module see the article in the March 1982 issue of ETI. (Photostats are available from ETI Reader Services for $3).

12 V power supply

The transformer specified for the ETI-499 power amp module (which is also the transformer used in this project) has an auxillary 15-0-15 V winding which is used, in this project, to provide the positive and negative supply rails for the op-amps in the preamp boards.

The power supply board consists of a full-wave diode bridge rectifier which is filtered with two 2500 µF capacitors to form split rails of around 20 V. This is used to power 7812 and 7912 three-terminal regulators to provide the plus and minus 12 V rails used to run the op-amps.

Input board

The input board contains the initial gain control stage and the tone controls. Two inputs are provided which are designed to give maximum gains of 20 dB and 3 dB respectively. The tone controls are of the Baxandall type. These provide bass and treble control works in the region 20 Hz to 200 Hz and the treble control covers 400 Hz and up.

Equaliser board

The equaliser section is designed to provide unity gain with all controls set flat and 14 dB of boost and cut for each equaliser section. The equaliser consists of a series of filters incorporated into the feedback loop of an op-amp. This is based on the Series 5000 1/3-octave graphic equaliser published in the November 1982 issue of ETI. The equaliser has been configured to give centre frequencies of 50, 100, 250, 500, 1 kHz and 3 kHz, a total of six bands.

The output of the equaliser section is fed into a gain section which acts as master volume control with a maximum gain of 34 dB. This will give an overall maximum gain from the preamp of 34 dB or 40 dB depending on the input used. If the bass you are using has high output pickups, such as EMG types, then you may want to decrease this gain so as to get full use from your volume controls.

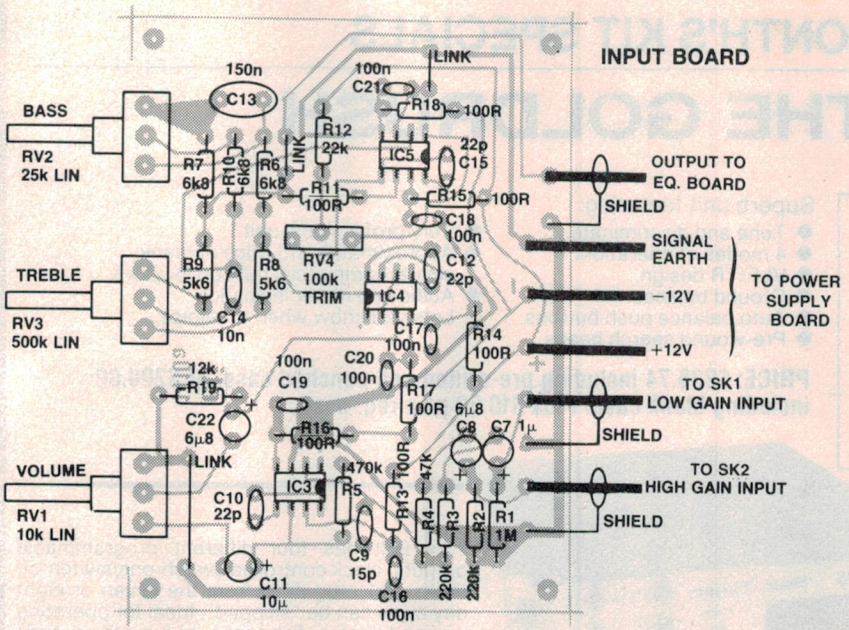
Slider pots are used to control the amount of boost or cut at the equaliser frequencies. These were mounted on a separate pc board which will mount on the front panel of the amp. The only problem you may encounter in this is cutting the slots in the front panel to accommodate the six sliders. This problem will be discussed in 'Constructional details' section in Part

Limiter/output board

This board contains several sections of the circuitry. Firstly, a limiter circuit. This uses an NE570 IC compander. Its function is to limit the output of the preamp to a maximum of 1 V RMS which means that large transients, such as occur when a bass string is struck hard, will not over-drive the power amp and cause unwanted clipping.

The output section of the board provides the drive stages for a line level output which can be used to feed a mixer or for recording. A state-variable filter is used to provide high-pass and low-pass outputs with the cutoffs variable from about 50 Hz to a few hundred Hertz. These outputs are used in the bi-amping facility which allows the use of an external power amp to drive a speaker covering the low frequency end of the spectrum. The internal power amp is then fed from the high-pass filter and amplifies the higher frequencies only.

Level controls are provided for the line and bi-amp outputs to enable matching of the signal levels to the equipment they're driving.



The output facilities provided on this board make the amp very versatile and easily expandable into a large, higher-powered system if 150 watts doesn't hurt your ears enough.

Construction of the pc boards

All of the boards are relatively easy to construct. First, however, check the boards to see that all holes are correctly drilled and that there are no broken tracks or 'bridges' between closely-spaced tracks. Start with the 12 V power supply board (ETI-1410a). Solder in the big electrolytic capacitors (C1 and C2) followed by four tantalum caps. Make sure that you get the correct orientation of these capacitors as they are all polarised and tend to fail rather spectacularly if inserted the wrong way round.

Next, solder the diodes in place followed by the two voltage regulators, IC1 and IC2. These too are polarised and must be placed the correct way round. It is advisable to use solder pegs on the lead connections to this board since several leads may need to be soldered to the same point.

Tackle the input board next. Start by locating and soldering the small link wires in place. Solder in all the resistors and capacitors next. Note that RV1, RV2 and RV3 are specified as the miniature pc mount type with the standard size shaft. These will sit directly on the pc board and are soldered in place. Standard pots can be used but these will have to be attached to the board with hookup wire and, since the prototype board was held on the front panel by the miniature pots, an alternative board mounting scheme would have to be used. The only thing that remains to be done on this board is the mounting of the ICs, one transistor and diode.

The use of IC sockets is not recommended when mounting audio ICs since the stray resistances and capacitances associated may affect the performance of the circuit. For this reason it is very important to put them in the right way round first time. It can be a real pain in the thumb to go round de-soldering ICs if a mistake is made. This then completes the construction of the input board.

The board left to construct at this stage is the main power amp board. As previously mentioned, this is the ETI-499 MOSFET power module which was described in the March 1982 issue. This should be constructed as shown in the original article (with the omission of the large heatsink since a different one is used in this project). If you are one of the very few people who do not have every copy of ETI ever published, then you can obtain a photocopy of the article by writing to our general enquiries service as detailed on page 3 of this issue.

Once all the boards have been completed a thorough check should be made to ensure that there are no small solder bridges between tracks on any of the boards and that all ICs and any other polarised components are mounted the correct way round. This then, completes the first part of the construction of the bass amp.

Next Part

In Part 2 of this article, the details of the final board (the limiter/output circuits) will be given as well as full constructional details, wiring diagrams and front panel artwork. For those experimenters out there, a few optional circuit ideas will be discussed which could be incorporated into the amp if you're after some super-deluxe features. ●

PARTS LIST — ETI-1410a PREAMP

Resistors ..... all ¼W, 5% unless noted
- R1 ..... 1M
- R2, 3 ..... 220k
- R4 ..... 47k
- R5 ..... 470k
- R6, 7, 10 ..... 6k8
- R8, R9 ..... 5k6
- R12 ..... 22k
- R11, 13, 14, 15, 16, 17, 18 ..... 100R
- R19 ..... 12k
- RV1 ..... 10k/C rotary pot (Soanar V16L)
- RV2 ..... 25k/A rotary pot (Soanar V16L)
- RV3 ..... 500k/A rotary pot (Soanar V16L)
- RV4 ..... 100k min trimpot

Capacitors
- C7 ..... 1µ/10 V tant
- C8, C22 ..... 6µ8/10 V tant
- C9 ..... 15p ceramic
- C10, 12, 15 ..... 22p ceramic
- C11 ..... 10µ tant
- C13 ..... 150n greencap
- C14 ..... 10n ceramic
- C16, 17, 18, 19, 20, 21 ..... 100n ceramic bypass

Semiconductors
- IC3, 4, 5 ..... NE5534N, LM5534N

Miscellaneous
- SK1, SK2 ..... 6.5 mm insulated, earthing-type, panel-mount mono jack sockets.

ETI-1410a pc board; hookup wire.

Price estimate: $17-$20

PARTS LIST — ETI 1410b ±12 V SUPPLY

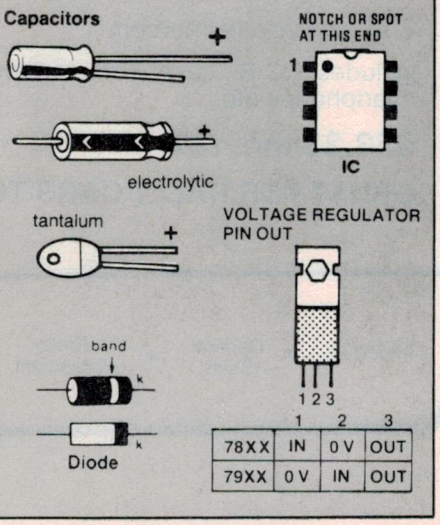
Capacitors
- C1, C2 ..... 2500µ/35 V axial electros
- C3, 4, 5, 6 ..... 10µ/35 V tant

Semiconductors
- D1-D4 ..... 1N4001, 1N4002, etc
- IC1 ..... µA7812, LM340/T12
- IC2 ..... µA7912, LM7912

Miscellaneous

ETI-1410b pc board; pc pins; hookup wire (T1 is the main transformer, the HT secondary of which supplies the power amp section of the project — see Part 2).

Price Estimate: $12-$14



Mains frequency generator

H. Nacinovich, Gulgong NSW

This circuit was designed to operate a 240 V/3 W telescope drive motor but it would be suitable for many other low power applications. It could also provide the basis for a high power version, with suitable modification to the output stage.

For its present purpose, the most important requirement is for a highly stable, 50 Hz operating frequency. This is achieved by using a 3.5795 MHz crystal and an MM5369EYRN IC, which were chosen for their low cost and ready availability. The MM5369EYRN IC contains an oscillator and all the divider circuitry necessary to produce a precise 50 Hz square wave output when used in conjunction with the 3.5795 MHz crystal.

One disadvantage of this IC, however, is that its output is not an exact 50/50 duty cycle square wave. For some applications this may not matter but, if used directly to drive an output stage in a high power convertor, for example, the asymmetrical waveform could result in significant unbalanced dc currents sufficient to saturate the output transformer. Also, for high power convertor applications, at least, it is desirable to drive the output transistors (usually in push-pull) with a delay between turn-off of one set of output transistors and turn-on of its complementary set of transistors.

This circuit provides both a symmetrical drive current waveform to the output transistors and the delay referred to above. This is achieved using only two low cost, easily obtainable ICs, a 4046 CMOS phase lock loop and a 4022 octal counter.

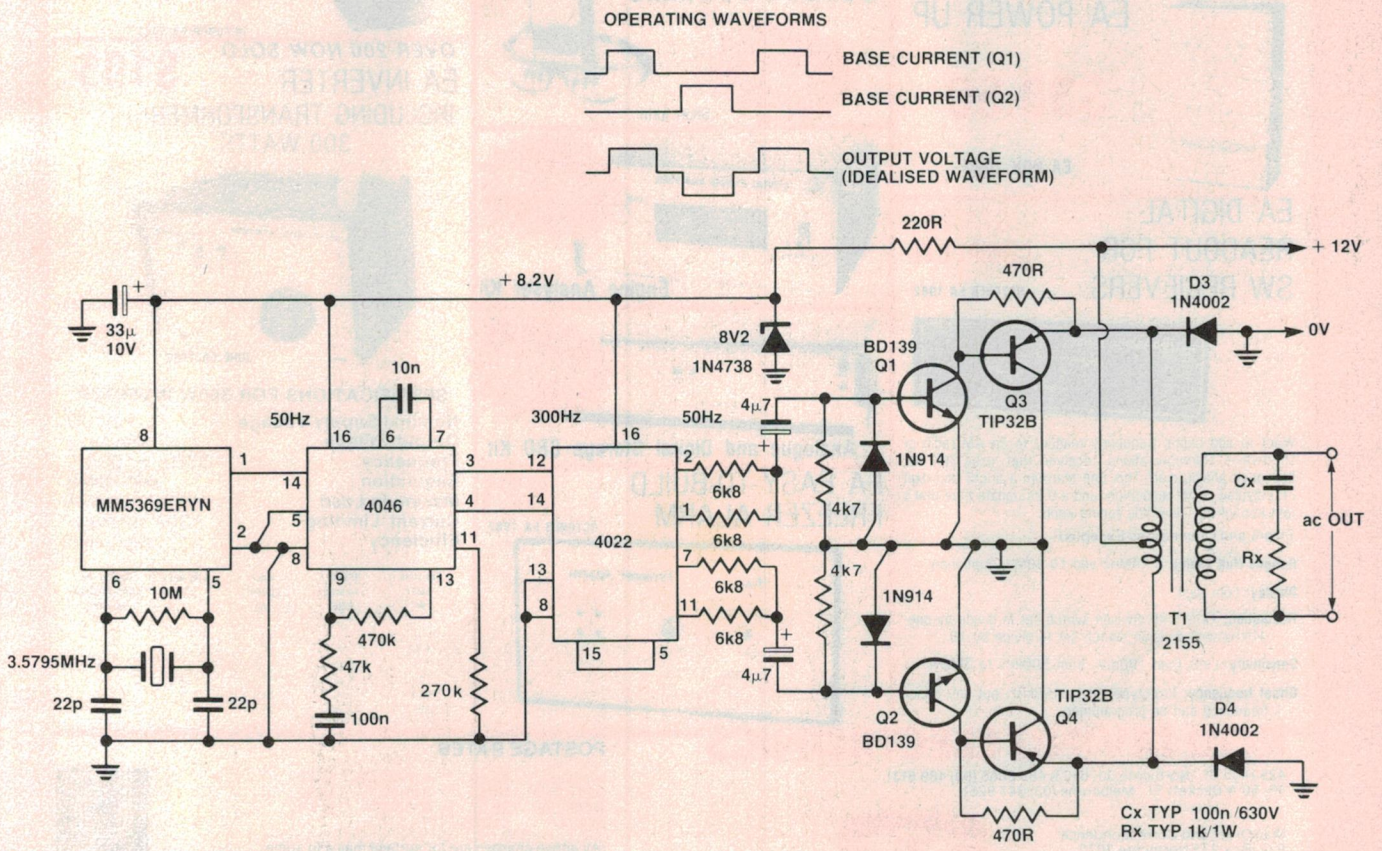
The counter is arranged in a feedback loop with the 4046 in such a way that the output is locked precisely to the 50 Hz input derived from the 5369 IC. The 4022 has, in fact, eight outputs which go sequentially high when the counter is clocked. In this case the 4022 is connected as a divide-by-6 counter, with four of its outputs being used to supply input drive to transistors Q1, Q2. The sequential operation of the 4022 outputs is taken advantage of here to obtain the waveforms shown in the diagram without the need for any extra gating. The idealised ac output waveform has a 4:2 on/-off ratio which gives a theoretical peak/rms ratio similar to that for a sine voltage waveform.

The output section is conventional. It comprises a pair of transistors Q1, Q2 in push-pull driving a pair of output transistors Q3, Q4 respectively, which in turn are coupled to an output transformer, T1. The transistors Q1, Q2 are ac coupled to the 4022 outputs, rather than dc coupled, to ensure that all the transistors are turned off in case oscillation ceases for any reason, e.g: in case of a fault.

The output transformer is a commonly available type with a 240 V/15 V centre-tapped winding ratio which, assuming a 12 V battery supplying the circuit, will theoretically give a 384 V peak (256 RMS). In practice an output closer to 360 V peak (240 V RMS) is obtained due to circuit losses.

Maximum continuous output power is around 10 W. If higher output power is required it will be necessary to substitute a suitably rated transformer and output transistors with correspondingly increased current/power ratings. It may also be necessary to use Darlington output pairs to obtain the increased output current.

Diodes D3, D4 and a series RC network across the transformer secondary minimise switching spikes in the ac output. Some experimentation with the values of C_X, R_X may be necessary for optimum suppression depending on transformer type and output loads.



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THIS MONTH'S KITS

Please ring for price and availability

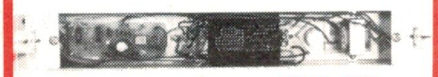
150 WATT BASS GUITAR AMP

Featuring a five-band graphic equaliser and 150 watts output (using the popular and reliable ETI-499 MOSFET module), this rack-mounted amp performs really well. We know, the designer plays bass in Sydney group, Rafequats Right Foot!

ELECTRONIC MOUSE TRAP

The breaking of the drought has brought on a mouse plague.

Tried to buy a mouse trap lately? You can't. Well, here is an electronic mouse trap that despatches the beasts swiftly and perhaps a little more humanely than traditional methods. What's more, it re-sets itself. Simple, and cheap to build.



$89.50

ETI-669 PANGALACTIC EPROM ERASER

If you walk into the restaurant at the end of the universe and tell the bartender you're confused, he'll say "don't panic!, have a pangalactic gargleblaster. It will erase your current existence allowing The Master to reprogram you for another time and space". Well, our little EPROM eraser does a similar job for your 2716s, 2732s, 2764s ... et al. Parts list attached.

Led Head Lightchaser

(Battery and headband extra)

$12

PLUG PACK REGULATOR

$14

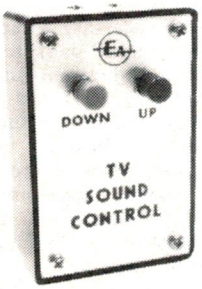
Plugpack Extra

$55.00

STEREO SYNTHESISER FOR TUNERS AND VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.

REMOTE INFRARED TV SOUND CONTROL



E.A. JANUARY "83".

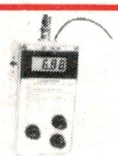
$40

Designed to relieve the long-suffering TV viewer from painful, brain-killing advertisements, our TV Sound Control provides remote control of volume. It gives eight steps of control, including full off, when total silence is called for. Give yourself a break and relieve advertising tedium today.

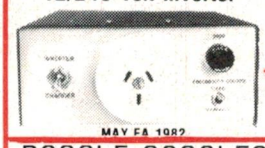
PH METER

$135

with probes



12/240 volt Inverter 40 WATTS



MAY EA 1982

$49.50

EA ELECTRONIC STARTER FOR FLUORESCENT LAMPS

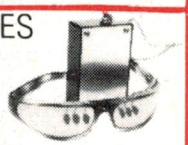
$4.95

OCTOBER EA 1982

BOGGLE GOGGLES

$9.60

Short form



EA POWER UP

$38.50

EA NOV 1982

EA DIGITAL READOUT FOR SW RECIEVERS

$72.00 COMPLETE

OCTOBER EA 1982

Want to add digital frequency readout to an AM radio or shortwave communications receiver that uses an old-fashioned analog dial? This unit features a bright four-digit LED display, 1kHz resolution, and a 0.2s update time that's fast enough to follow the tuning knob.

Errors and Ommissions Excepted

Ranges (full scale): 0-10MHz and 10-30MHz (optional).

Display: Four digit.

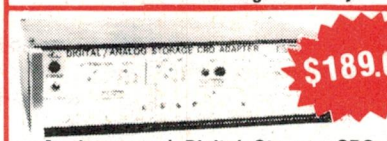
Resolution: 1kHz with division switch set to divide by one; 10kHz with division switch set to divide by 10.

Sensitivity: Less than 100mV from 500kHz to 30MHz.

Offset frequency: Prototype set to 455kHz, but any offset frequency can be programmed.

$48.50

Engine Analyser Kit



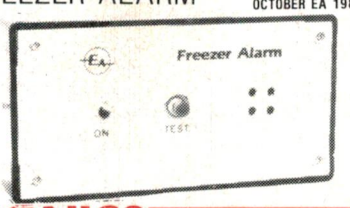
$189.00

Analogue and Digital Storage CRO Kit

EA EASY-TO-BUILD FREEZER ALARM

$21

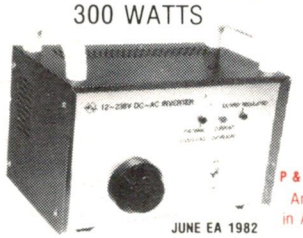
OCTOBER EA 1982



OVER 200 NOW SOLD

EA INVERTER INCLUDING TRANSFORMER 300 WATTS

$195



JUNE EA 1982

P & P $10.00 Anywhere in Australia

SPECIFICATIONS FOR 300W INVERTER

Nominal Supply Voltage	12V DC
Output voltage	see table
Frequency	50Hz ± .005%
Regulation	see table
Maximum Load	300VA
Current Limiting	30A (primary)
Efficiency	see table

Resistive load W	Output voltage (RMS)	Input current (A)	Efficiency (%)	Battery life 40Ah/20h rate (minutes)
no load	240	1.2	0	
30	235	3.5	60	240
100	230	11.3	82	80
140	240	15.0	89	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

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$500+	$12.00		

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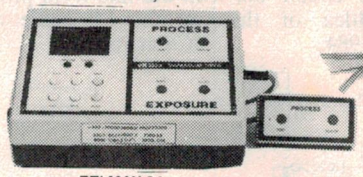
Reg. post for orders over $200 included "free".
Account orders from schools, govt. depts., public co's., gratefully accepted. Min order amount $20.00 (or a min. $5.00 accounting charge will apply.) Comet Road Freight, Airmail etc. are extra.

Please ring for price availability on new kits

ETI 662D Darkroom Timer

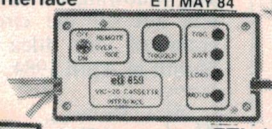
Another in our series of photography projects. Digital readout, countdown – Style timer.



ETI MAY 84

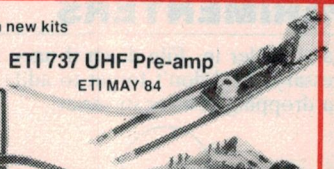
ETI 659 VIC-20 Cassette Interface

ETI MAY 84



ETI 737 UHF Pre-amp

ETI MAY 84



ETI 1421 Indoor Paging Amp. System

For clubs, halls, offices, etc.

ETI MAY 84

ETI-662A GENERAL PURPOSE MICROPROCESSOR CONTROLLER

ETI APRIL 84

A microprocessor with a bit of ROM, a bit of RAM and some I/O lines. This project based on the 6802 will form the basis of a series of projects.

ETI-1521 DIGITAL EXPOSURE METER

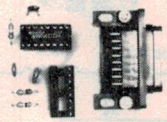
Don't be caught with indecent exposure! Our digital exposure meter is low in cost, simple to build and operate and includes a three digit readout.

$9.00

$18.50 ETI Oct 83

ETI-412 PEAK PROGRAMME METER

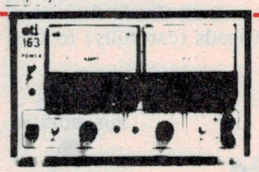
This project uses a 10-LED bargraph display module to show audio level from –23 dB to +6 dB. It's simple to build and set up.



ETI Oct 83 **$16.50**

ETI-672 MICROBEE TELETYPE INTERFACE

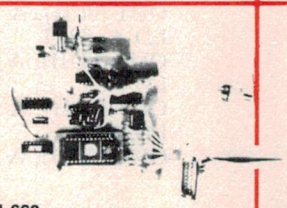
The 'Claytons' of printers is the old surplus teletype—such as the Model 15 etc. For around a tenth the price of a dot-matrix printer, you can have hard copy from your microbee using this simple interface.



ETI MAY '83

ETI-163 LAB SUPPLY **$165**

Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges 0–0.5 A/0–5 A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary.



ETI-668 MICROBEE EPROM PROGRAMMER **$47.50**

ETI FEB '83

Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

ETI-153 TEMP. PROBE

$19.95

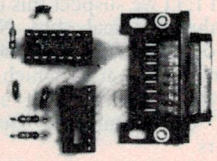
ETI JUNE '83

Can measure temperature from –50°C to +150°C. It simply plugs into your multimeter—great for digital multimeters. Accuracy of 0.1°C resolution of 0.1°C.

ETI-678 MICROBEE ROM READER

This project enables your favourite games or utilities to be loaded quickly into your Microbee from an EPROM – no more agonising waiting for a cassette to load or going to the expense of a disk system.

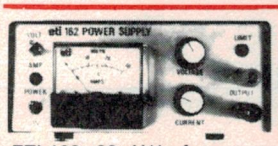
ETI MARCH 84 **$17.50**



$13.50 ETI Oct 83

ETI-671 MICROBEE PRINTER INTERFACE

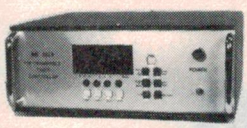
A simple interface unit for parallel printers.



ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY **$47.50**

ETI DEC '83

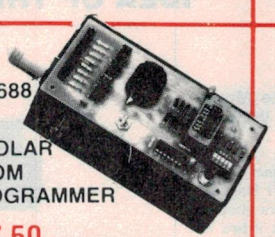
The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.



ETI-662B TIMER/CONTROLLER

This project superceeds the ETI-650 STAC Timer providing more versatility and easy programmability.

ETI APRIL 84



ETI-688 BIPOLAR PROM PROGRAMMER

$47.50 ETI JUNE '83

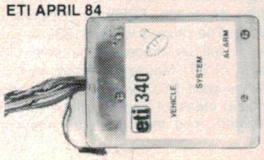
Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188, 288, 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP **$20.00**

ETI Oct '82

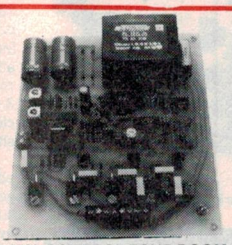
This project can be used as a balanced mic amp with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI APRIL 84



ETI-340 CAR ALARM/MONITOR SYSTEM

Features three delays — entry, exit and alarm length. Immediate-trip perimeter alarm sounds if battery, tyres lights, etc are disconnected. Circuitry is based on all common parts (555s, 40001s, BC457/8/9s, 1n4002s etc.).



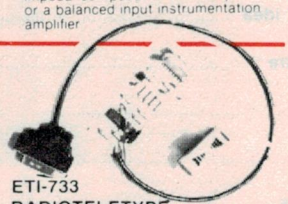
ETI-1522 CONTROL FOUR ROOM LIGHTS OVER A TWO-WIRE PAIR

It is probably a not-uncommon problem to want to replace the single ceiling light in a room with a more exotic arrangement only to find that the control wires to the switch are concreted in! Either that, or you don't want to "chase" more wires through the wall and have to replace the wallpaper and/or redecorate. This project fixes that.

ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply programmed with two pushbuttons to provide the wiping delay you need.



ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE **$20.00**

ETI APRIL '83

Have your computer print the latest news from the internation shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

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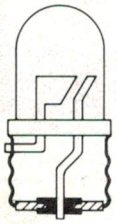
IDEAS FOR EXPERIMENTERS

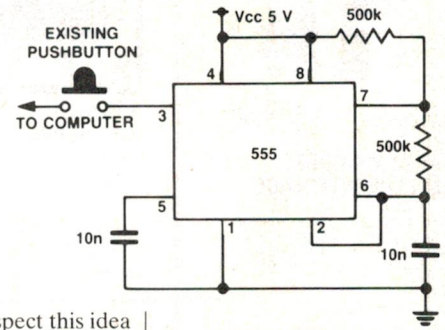
Screw-in LED

Utilising the metal bases from blown lilliput-type globes you can make screw-in LEDs to replace globes inside small switches and bezels. **Mike Home** of **Mitcham, Vic** has found this to be much more reliable than incandescent indicator lamps.

Just clean the solder from the base, cut a small slot in the rim, bend the leads (carefully) to fit and solder in. File down if necessary. And don't forget to add a dropping resistor in series!



Rapid Fire Paddle



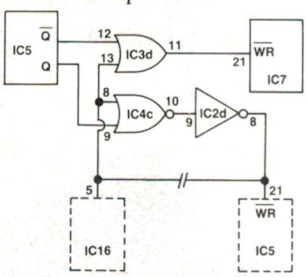
Here at ETI we suspect this idea is highly unethical, but **Nigel Senior** of **North Fitzroy Victoria**, has sent us this idea which assures you a better than even chance of winning at Space Invaders.

The idea is to put a simple bistable inside the computer joystick. Pressing the fire button will make the system fire at a rate determined by the software of the game itself.

Now, to give the invaders a chance, play blindfolded!

ERRATA

The following bit of circuitry was left off the circuit diagram of our Idea of the Month in April 1984:



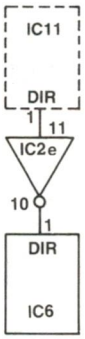
Notice that the WR lines of IC7 and **IC5** should not be joined, but should be connected as shown.

There is also an error in the program listing that accompanied the article. These should read:

1.

```
LD A, 50H
LD (0D3H), A
LD A, 59 H
LD (0D4H), A
LD HL, 0E1 H
CALL 85A7 H
```

There should be an inverter in the line from pin 1 of IC11 on the Microbee to pin 1 of IC6 as follows:



2.

```
LD A, 2
OUT (0CH), A
LD A, 59 H
OUT (0DH), A
LD A, 1
OUT (0CH), A
LD A, 50 H
OUT (0DH), A
```

'IDEA OF THE MONTH' CONTEST

COUPON

Cut and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright.*"

* Breach of copyright is now a criminal offence.

Title of idea .....

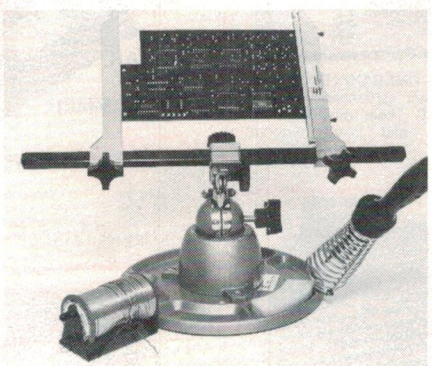
Signature .....

Name .....

Date .....

Address .....

..... **Postcode** .....



Scope pc board Work Centre

PRIZE WORTH $123!

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month we will be giving away a pc board Work Centre consisting of the Model 315 adjustable pc board holder with capacity to accept 300 mm boards, Model 300 180° swivel and lock base which can be attached to the Model 312 tray base with wet sponge receptacle, Model 371 solder spool holder and Model STS 3 soldering iron safety stand. Please note prize does not include solder or scope TC60 temperature controlled iron shown above. The prize is worth $123!

Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

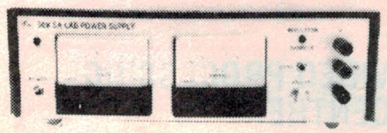
The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

ROD IRVING ELECTRONICS

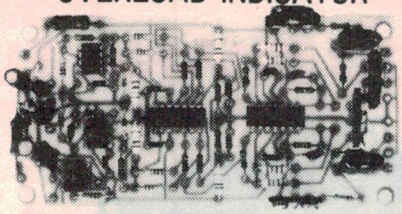
50V 5A LABORATORY POWER SUPPLY



New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
EA May, June 1983

$140.00

OVERLOAD INDICATOR

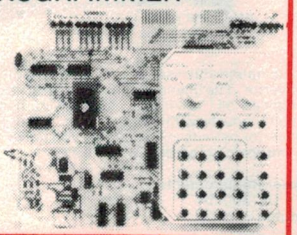


Will detect even slight overload conditions and is not affected by load impedance or varying supply voltages. **E.A. JUNE '83**

$75.00 EFFECTS UNIT

An "Effects Unit" that can create phasing, flanging, echo, reverb and vibrato effects. **E.A. JUNE '83**

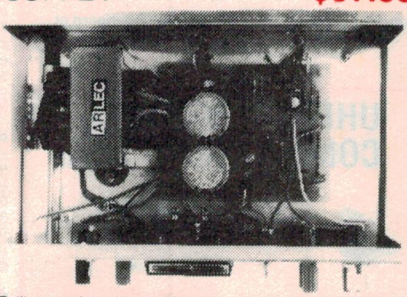
EPROM PROGRAMMER $43.00



No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

With Textool Sockets $55.00
EA January 82

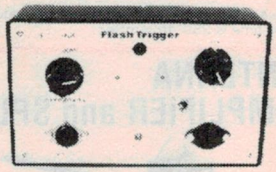
DUAL TRACKING POWER SUPPLY $87.50



Built around positive and negative 3-Terminal Regulators this versatile dual tracking Power Supply can provide voltages from ±1.3V to ±22V at currents up to 2A. In addition, the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway. **EA March 82**

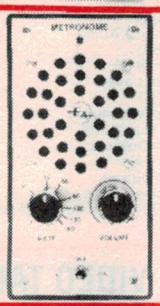
SOUND TRIGGERED FLASH $26.50

This easy to build sound or light operated flash trigger has many feature.



Catch those spectacular and humorous moments like that time your mother-in-law slipped on the moss covered patio and broke her neck. **ETI 568 October 80**

ELECTRONIC METRONOME $18.90

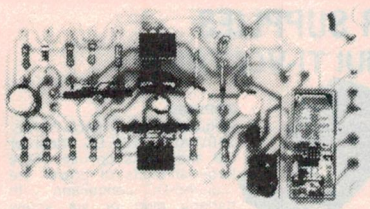


Great new Metronome Circuit with low current drain (less than one milliamp) drives a Loudspeaker and a Led Indicator. **EA January 82**

"LE GONG" $14.95

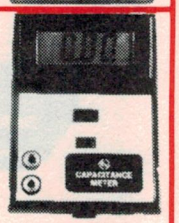
The "Le Gong" Doorbell with those unmistakable chimes generated by the LSI. A must for the man who has everything! **EA February 81**

VOICE OPERATED RELAY $14.95



EA's great new Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. **EA April 82**

3½ DIGIT LCD CAPACITANCE METER



Handy pocket size Digital Capacitance Meter, runs off a 9V battery and measure 1pF to 19.99uF in just three ranges.
EA March 82

$89.95

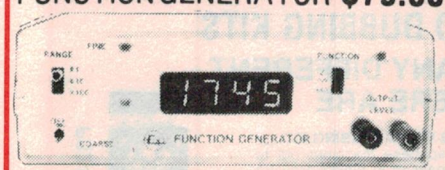
LED LEVEL METER $27.00

Build a Led level Meter with simultaneous peak and average display plus 60dB dynamic range. This kit is ideal for any application requiring a wide dynamic range level display. **ETI 458 June 81**

LOW OHMS METER $34.50

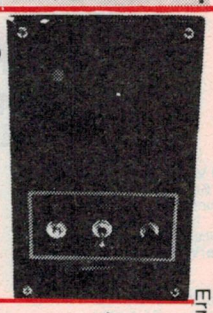
How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. **ETI 158 November 81**

FUNCTION GENERATOR $79.50



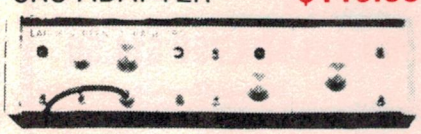
This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160kHz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. **EA April 82**

LOTTO/POOL'S SELECTOR $22.50



You have to be in it to win it . . . Take the chance out of winning the Pools as well as Lotto, and build the great new Pools/Lotto Number Selector. **EA July 81**

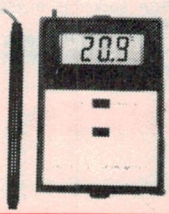
LARGE SCREEN TV STORAGE CRO ADAPTER $119.00



For a low cost Storage CRO with Synchronised Display, Electronic Graticule, One-Shot Triggering and Optional Storage of up to four Screen Displays it can't be beaten. **EA February 82**

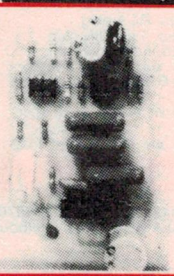
DIGITAL THERMOMETER: 3½ DIGIT LCD

$89.95



Measure temperatures from below freezing point to around boiling point. **EA February 82**

SOUNDBENDER $29.00



Have great fun creating your own recording effects with music and voice. The Sound Bender can receive from Electric Guitar, Microphones, etc. **ETI February 82**

Errors & omissions excepted

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$500+	$12.00		

(All above charges are for surface mail and some heavy items will vary from these rates.)

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Cert. post for orders over $100 included "free".
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Account orders from schools, govt. depts., public co's., gratefully accepted. Min order amount $20.00 (or a min. $5.00 accounting charge will apply.) Comet Road Freight, Airmail etc. are extra.

NEW PRODUCTS!

FROM ROD IRVING ELECTRONICS

AUDIO DIGITAL DELAY

FEATURES:

*Originally developed A D adapting circuit (equivalent to 14-bit-circuit) is adopted.
*The wide delay range of 1-1024mSec. enables you to obtain the big variety of sound effect (Slap Back. Doubling. Flanging. Chorus or Lond Delay).
*The wide frequency range of 16 kHz enables you to use the apparatus for any purpose (Vocal. Guitar. Keyboard or P.A.).
*The special function of "HOLD" is provided in this model. Hold time is 250-1024mSec.

$479.00

ANTENNA AMPLIFIER and SPLITTER

$29.95

Great Value at $29.95 An ideal unit for where you can't get to the top of your antenna

AA1 ANTENNA AMPLIFIER/SPLITTER
UHF/VHF/FM indoor antenna amplifier and 2 way splitter-ideal for home. boats. caravans-Covers all Australian frequencies-75 ohm in 2 x 75 ohm out-gain 2 x 6dB-power supply 12V DC 100mA (supplied)

UHF TO VHF DOWN CONVERTER L11042

$59.95

A Ready Built Unit. For units with VHF O/PS line computers and VCRs.

VUC1
UHF to VHF down convertor-has built in amplifier to ensure no signal loss-selectable channel 1, 3, & 4-power supply 12V DC 100mA (supplied). Converts UHF signal to VHF-allows TV without UHF to use VCR-Video game or to receive off-air UHF signal-switchable to channel 1, 3 and 4

NEW BENCH POWER SUPPLIES
NEAT CONSTRUCTION MUI TI-VOLTAGE

PP1000
Power pack 1 amp-240V AC to 6-7½-9-12V DC. Ideal for the workshop-DC connection with banana plugs or via screw terminals. Suits our MD 12 Mini Drill-MS402P powered speakers and many other applications

$19.95 M19025

RPP2000
Regulated power pack-2 amp-240V AC to 12V DC. Ideal for CB and workshop use where large amounts of power are equired-DC connection with banana plug or via screw terminals

$39.95 M19030

MULTI- PURPOSE VIDEO DUBBING KITS
IT'S AMAZING HOW MANY DIFFERENT TYPES OF VIDEO THERE ARE

VDK1 VIDEO DUBBING KIT
For European to Japanese machines-packed in plastic tray for easy storage and identification-contains
Audio/Video: 6 pin DIN plug to 6 pin DIN plug 1.5 metres
Audio/Video: 6 pin DIN socket to a) Video: RCA plug
b) Audio: 5 pin DIN plug (both 16cm in length)
Video: 1 each plug adaptor-(PA21) RCA socket to PL259 plug
(PA23) RCA socket to BNC plug
Audio: 5 pin DIN socket to 2 RCA plugs 16cm length
2 plug adaptors (PA60) RCA socket to 3.5mm phone plug


P32190

$16.00

VDK2 VIDEO DUBBING KIT
All Japanese machines-old to new-packed in plastic tray for easy identification of part and tidy storage-contains
Video: RCA PLUG TO RCA PLUG-1.5 metre-75 ohm
2 plug adaptors (PA23) RCA socket to BNC plug
2 plug adaptors (PA21) RCA socket to PL259 plug
Audio: RCA plug to RCA plug-1.5 metres-shielded cable
2 pcs 5 pin DIN plug to 2 RCA sockets (in/out)-16cm
2 plug adaptors (PA60) RCA socket to 3.5mm phone plug


P32192

$19.95

VIDEO PROCESSING CENTRE

VP5050
Combination stabiliser. enhancer. distribution amplifier. RF convertor. The ultimate videophile component-designed to enhance all recording needs-will handle 3 VCRs simultaneously with virtually zero signal loss-built in RF convertor permits in-line connection between VCR and TV for improving recording whilst viewing

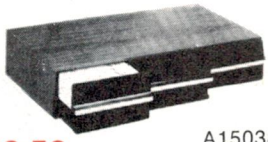
Power Requirements: 12V DC-300mA
Inputs: Video. Audio
Outputs: 3 Video. 3 Audio
RF UHF: Channel 36
Output Level: +0.3dB
Output Isolation: More than 40dB
Audio Outputs: Unity Gain
Input/Output: 75 ohms
*PP300 recommended power source

$119.00 A13012

VIDEO TAPE STORAGE BOX.

$19.95 A15037

TSC1 **BOX-6 pcs PER CARTON**
Tape storage cabinet-sturdy plywood cabinet-walnut grained vinyl-ABS storage trays-each tray holds 12 audio cassettes-a total of 36 cassettes in their boxes



$52.50 A15038

TSC2 **BOX-3 pcs PER CARTON**
Video tape storage cabinet-walnut grained vinyl-plywood cabinet-ABS storage drawers-each drawer holds 12 VHS or BETA tapes-total storage 36 video tapes

VIDEO TAPE PRICE SPECIALS
E180 $13.50 L750 $14.50

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$500+	$12.00		

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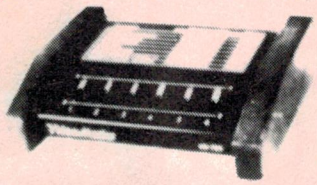
Account orders from schools, govt. depts., public co's., gratefully accepted. Min order amount $20.00 (or a min. $5.00 accounting charge will apply.) Comet Road Freight, Airmail etc. are extra.

VIDEO & AUDIO ACCESSORIES, TAPES, DEMAGNETISERS, MICROPHONES

Built and tested

VIDEO SWITCHING BOX



ON SPECIAL
$39.50

Low loss R.F. switching—allows inputs for:- VCR, video disc, antenna, cable TV, home computer and video games.

WE HAVE A GREAT RANGE OF VIDEO CONNECTORS AND CABLES FOR VIDEO TO VIDEO DUBBING.

Cables

PA-25
5 pin 180 degree dubbing adaptor — Reverse pins for video use $6.95

VC-14
8 pin square plug to 8 pin square plug. Cable length 2 metres $29.95

VC-15
6 pin DIN plug to 6 pin DIN plug. Cable length 1.5m $4.95

VC-1
BNC plug to BNC plug. Impedance-75Ohm. Cable length 1.5m $6.50

VC-2
BNC plug to PL259 plug. Impedance-75Ohm. Cable length 1.5m $6.75

VC-3
PL 259 plug to PL 259 plug. Impedance-75Ohm. Cable length 1.5 $4.95

VC-4
PL 259 plug to RCA plug. Impedance-75Ohm. Cable length 1.5m $4.95

VC-5
RCA plug to RCA plug. Impedance-75Ohm. Cable length 1.5m $5.95

VC-6
BNC plug to RCA plug. Impedance-75Ohm. Cable length 1.5m $5.95

Video Connectors

VP-8
8 pin square video connector plug $7.50

VS-8
8 pin square video connector inline socket $7.50

VP-10
10 pin male video plug. Used in J.V.C., Panasonic, Sharp and other VHS machines $11.50

VS-10
10 pin female inline socket. Used in J.V.C., Panasonic, Sharp and other VHS machines $11.50

VP-14
14 pin male video plug. Used in Sony, Sanyo, Toshiba and other Beta machines $16.50

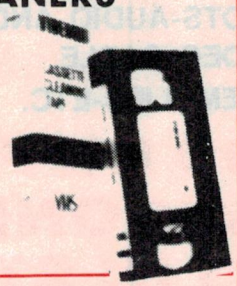
VS-14
14 pin female inline socket. Used in Sony, Sanyo, Toshiba and other Beta machines $16.50

VIDEO HEAD CLEANERS

HC-1 V.H.S. Video head cleaner
HC-2 Beta Video head cleaner

A professional head cleaner—employs new "double sided" cleaning action—no need to "operate" on your machine. Just insert the cassette, play for 30 seconds and the job's done. Effective for 100 operations.

HC-1 $17.50 HC-2 $17.50



ELECTRONIC CASSETTE DEMAGNETISER

Cassette heads should be demagnetised every 30 hours for optimum performance. Technically the best available and easy to use, completely automatic — with LED indicator

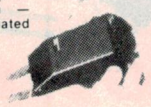
Battery: LR44, SR44
Battery life: 600 applications
Flux density: 220 gauss/650Hz
Circuit: 4 transistor — 4 diode

$16.95

HD-2 HEAD DEMAGNETISER

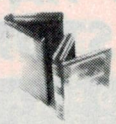
Twin probe for more effective magnetic field. 240V AC operation — on/off switch — indicator light insulated tip

$14.95



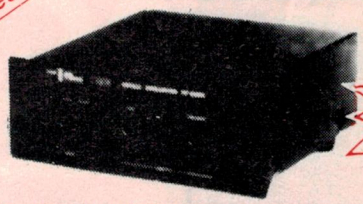
Video library storage case — looks just like hard cover book — with identification card pouch

	1-9	10+
A15035 BETA	$2.75	$2.25
A15036 VHS	$2.95	$2.35



Built and tested

VIDEO ENHANCER



Bargain Price
$75.00

Detail Enhancer VP5030 is another important contribution to the world of video accessories. The lightweight Detail Enhancer has been particularly designed to rectify loss in detail derived from VCR tapes and picture impairments. With simple adjustments for more or moderate detailing, the detail enhancer can also overcome such picture impairments as loss of detail and disappearance of verticle lines.

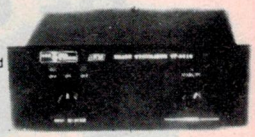
Specifications:
1. Power requirement: 12V DC 110mA
2. Input: 1 Video (RCA connector)
3. Outputs: 3 Videos (RCA connectors)
4. Output level: Video outputs: 1.0Vp-p, 75 Ohm unbalanced below 1Vp-p out
5. Enhance: Enhance 9dB (Reference 1.0Vp-p)
6. Signal-to-noise ratio: Greater than 50dB below 1Vp-p out

VIDEO STABILIZER

VP-5010

Image stabilizer — ensures no vertical roll or blackout occurs. With slight adjustment immediately stabilises picture of pre-recorded tapes — removing the copyguard signal, which tends to upset video recorders

Power Requirement	9VDC negative earth*
Input	2 video (RCA connectors)
Output	1 video (RCA connector)
Oscillator Freq.	3590Hz
Output Level	Video out 1.0V P.P. 75 ohm unbalanced
Gain	1 (0dB)
	*PP300 recommended power source



$79.50

DM726L LOW IMPEDANCE — OMNI DIRECTIONAL... $11.95
DM726H HIGH IMPEDANCE — OMNI DIRECTIONAL....$12.50

Impedance:	L = 500 ohm H = 20K ohms
Freq. response:	40-14KHz
Cord/Plug:	1.5 metres/6.5mm plug
Dimensions: With on/off switch	500 × 272mm

WIRELESS MICROPHONE

Tunable	88-108MHz
Freq. Response	100-10KHz
Battery	1.5V UM3/AA
Type	Electret condenser

$11.95
THIS MONTH ONLY

Errors and omissions excepted.

DM-18 STOP/START CASSETTE MICROPHONE

Impedance: 200 ohm
Freq. Response: 250-10KHz
Sensitivity: −74dB
2.5 and 3.5mm plugs

$5.95

TDK AUDIO TAPES

	1-9	10+
D 46	2.64	1.93
D 60	2.86	2.09
D 90	3.08	2.31
D 120	5.23	3.85
AD 60	3.47	2.86
AD 90	4.29	3.30
AD 120	6.49	5.39
ADX 60	4.46	3.30
ADX 90	5.28	4.18
SA 60	4.68	3.74
SA 90	5.28	4.29
SAX 60	5.78	5.06
SAX 90	6.38	5.72
MAC 60	10.45	9.35
MAC 90	11.28	8.75
MAR 60	13.42	10.95
MAR 90	17.29	15.35

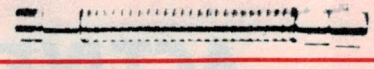
TDK VIDEO TAPES

60	12.50	11.00
120	14.00	13.00
180	15.00	14.50
240	25.00	23.50

GN15

Goose neck 5/8" male to 5/8" female 15cm long

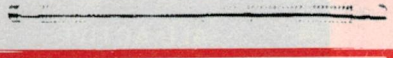
$4.95



GN33

Gooseneck 5/8" male to 5/8" female 33cm long

$6.95



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THE LARGEST RANGE OF COMPONENTS IN THE CITY

E.T.I.- E.T. & T.E. ELECTRONICS KITS.
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Personal 'lap' computers banned on flights

Several US-based airlines, including the big operator Eastern Airlines, have banned the use of personal computers while their aircraft are in the air.

Airlines have taken the move because of potential hazards caused by the RF radiations from the computer. The move complements long standing bans against the operation of radio transmitters of all types while the aircraft is in the air.

At present, major aircraft manufacturers are planning comprehensive tests to see whether a permanent ban is necessary. The problem has only just surfaced because of the growing complexity of aircraft.

In the 'good old days' it was difficult for a personal computer to interfere with aircraft systems, either because they were mechanical rather than electrical or because all the electronic systems were crowded up into the nose.

But the latest generation of aircraft are just like flying computers. The Boeing 767, for instance, has some 107 microprocessors scattered around the airframe, all taking to each other, and all vulnerable to low level RF radiation.

According to Tony Hill, of Ansett, the trouble was first suspected when it was established that the in-flight operation of a personal computer had interfered with the cabin pressurisation system of a 767. There have been allegations that navigation systems have been interfered with, but until now there has been no proof.

Australian airlines are adopting a wait-and-see approach. As general policy, Ansett cabin staff have been instructed to ask passengers to refrain from operating computers in the air. They are also carrying out their own in-service checks on the 767. The current view is that the Boeing 727, which is the result of 20-year-old technology, is not sophisticated enough to be vulnerable.

No other Australian airlines have yet introduced a ban on the use of personal computers, but they are all watching the situation closely. The International Air Transport Association (IATA) has a technical committee looking at the question at the moment, and no doubt its recommendations will seriously influence the course of events.

In the meantime, not all airlines are taking the situation seriously. United Airlines, another big US operator, is offering its passengers free in-flight video games as a sales gimmick. They are specially built into the food trays on its DC 8 airliners.

Universal EPROM programmer

AJ Distributors has just announced the release of its latest import, the Digelec EP-804 universal EPROM programmer and simulator.

According to Digelec, the EP-804 can accept over 90 different types of EPROMs without additional hardware. It combines simplified programming methods with comprehensive data handling and editing functions. All the programming algorithms are software-controlled so the need for hardware adaption is avoided.

The EP-804 has an RS232 interface port with which it can communicate with a host computer. It can handle baud rates up to 19.2K.

There is an EPROM simulator in the EP-804 which can be used for the development of programs. This on-board RAM has a 300 ns access time, so it can simulate the fastest EPROMs. RAM space is 32K.

For more information contact **A. J. Distributors, 214 Lyons Rd, Five Dock NSW 2046. (02)712-1077.**

The EP-804 EPROM programmer and simulator.

Mini-pak

Pulsar Electronics, a manufacturer of STD buss micros has announced the release of its mini 'Mini-Pak' series of microcomputers.

The systems can be configured using a number of combinations e.g: twin 1.3M 5 ¼" hard disk drives or 15M hard disc with 1.3M back-up drive. Each system contains a four way STD buss ac card cage to enable the use of Pulsar's 256K RAM card and auto dial/auto answer modem card (along with 1800 different STD cards available world wide).

The Mini-Pak uses the Pulsar Little Big Board as the CPU and runs various operating systems such as CP/M 2.2, MP/M II, CP/NET and Pulsar Turbodos. Under Turbodos, multi-user or network systems to 512MB are available with upwards of 200 users.

For further information contact **Pulsar Electronics, Lot 2, Melrose Drive, Tullamarine Vic 3043. (03)330-2555.**

Apple sound

Thinking Systems has announced that they are to be sole distributors of the DX-1 sound processor.

The DX-1 is a new product for the Apple II for recording, processing, and playing back ordinary sound. With the DX-1 sound can be entered, saved, processed, sequenced, played, and generally modified under computer control in ways never before possible. While other systems generate and produce computer sound, DX-1 works with real sound, entered directly by a microphone or another source.

Sounds are converted to digital data through a high speed analogue-to-digital converter; software routines are then selected (or programmed) for playing and sequencing the sound data; the data is then output to a digital-to-analogue converter where sounds are reconstructed. The software can speed up, slow down, play backwards, forwards, and sequence sounds in any way.

For more information contact **Thinking Systems, P.O. Box 260, Cammeray NSW 2062. (02)90-6868.**

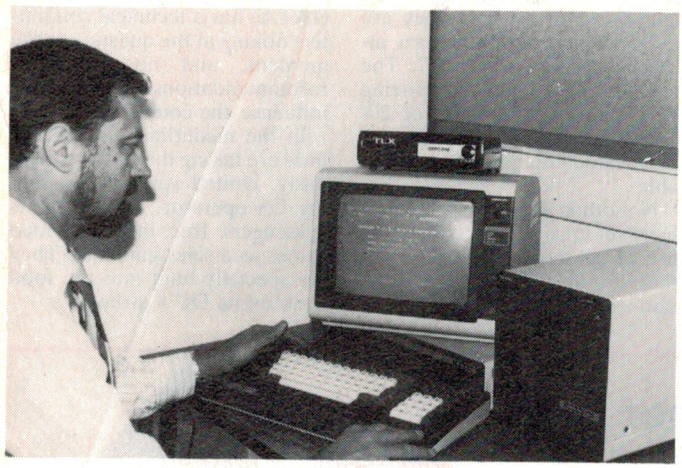
Software battlefield

According to a US market research firm, a lot of apparent benefits are going to wind up surprising software industry players who welcome them.

One example of this is 'hard' software — software produced on silicon chips. Software publishers tend to view this favorably since it seems to promise a reduction of the illegal copying that accounts for up to 50% of the software in use today.

However the report points out that it will transfer software publishing power into the hands of the hardware manufacturers. It predicts that machines like Apple's Lisa are the wave of the future and independents will be reduced to OEM'ing for the hardward suppliers or looking for a niche market themselves.

Teledistribution, the downloading of software in lieu of multi-copy publication, could spell the end of the retail shop when high speed downloading direct to end users becomes widely feasible.



AUS TOS

Many microcomputer users can now send and receive telexes without the added expense of installing a separate telex machine.

Sydney-based communications specialist, Offcom Pty Ltd, has developed a new version of its successful TOS (Telex Operating System) designed to suit most MS-DOS/PC-DOS microcomputer systems.

The sophisticated TOS system from Offcom allows the user to create and format messages on the microcomputer — either within the existing word processing package or from within TOS.

While TOS is activated the microcomputer becomes a multi-tasking machine capable of handling separate tasks at once. The operator can be preparing one telex on the screen while a second message is being transmitted and a third being printed.

Incoming calls are received and stored on diskette and outgoing calls are scheduled for later transmission. The messages can then be easily accessed and used at a later date — incorporated in a report or similar word processing document — without any rekeying, simply by using whatever word processing package runs on the microcomputer.

Up to 1000 frequently called numbers and answerbacks can be stored and recalled by abbreviated dialling or mailcode addressing, eliminating the need to look up and key in these numbers.

Even though the system is capable of automatically handling all the telex functions, the operator has options available for over-riding control — the facility to change or cancel the priority of messages queued for transmission, start, stop and restart the transmission queue and search and display from the queue.

The TOS package for microcomputers will be available through microcomputer dealers and dealer enquiries are welcome.

For further information contact **Offcom Pty Ltd, 28 Chandos St, St Leonards NSW 2026. (02)438-4199.**

Microsoft for Apple IIc

Microsoft has unveiled a new version of the Microsoft Multiplan electronic spreadsheet software that has been specially modified to run on the new Apple IIc.

Multiplan, the leading spreadsheet program for the Apple II family, is ideal for a wide range of budgeting, forecasting, and other financial analysis tasks in a home or office environment. Commands are always visible on the screen so the user never has to guess what to do next. Other features include on-line help, the ability to link worksheets together, and the ability to sort columns of data.

This 1.07 version runs on the Apple II, II Plus, and IIe in addition to the Apple IIc. It takes full advantage of the computer's 128K RAM memory to allow for larger worksheets and runs on either 40 or 80 column displays.

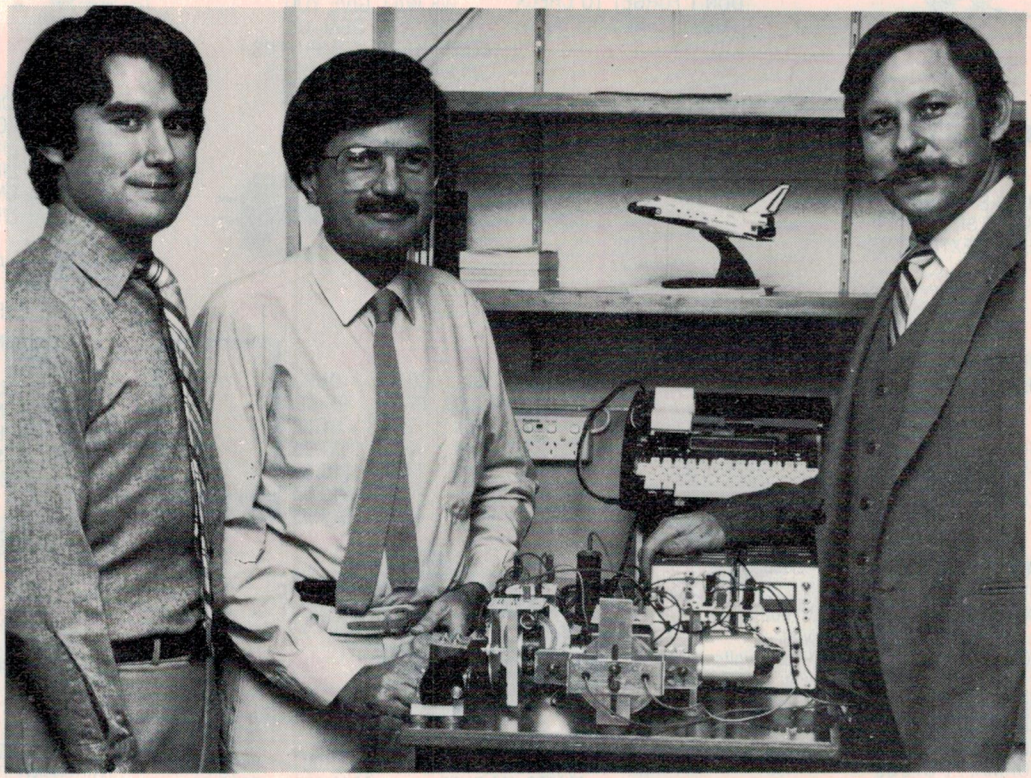
Retail price for Multiplan version 1.07 is $395. For more information contact **Microsoft at 1 York St, Sydney NSW 2001. (02)27-3571.**

First prize

A final year Electrical Engineering student at the Queensland Institute of Technology, Michael Philippi, departed on an eight-week advanced technology study visit to the USA on June 18 as part of an award for outstanding course project work involving computer aided design of a computer-controlled digital tachometer.

Michael of Wynnum in Brisbane, will visit the Semiconductor Products Division of Rockwell International at Newport Beach, USA. Rockwell is the prime contractor on the Space Shuttle and a world leader in advanced technology.

The award valued at $6500 and including a Rockwell AIM 65-100 microcomputer, was donated by Energy Control, Brisbane-based distributors for Rockwell.



From L-R. Michael Phillipi, Dr John Corderoy, Head of School of Engineering, QIT and Ken Curry from Energy Control.

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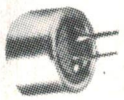

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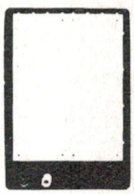

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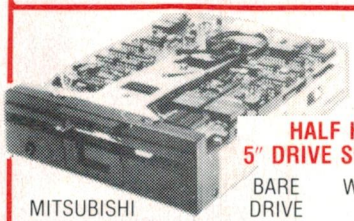

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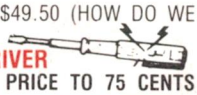

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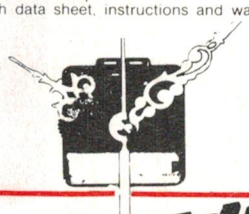

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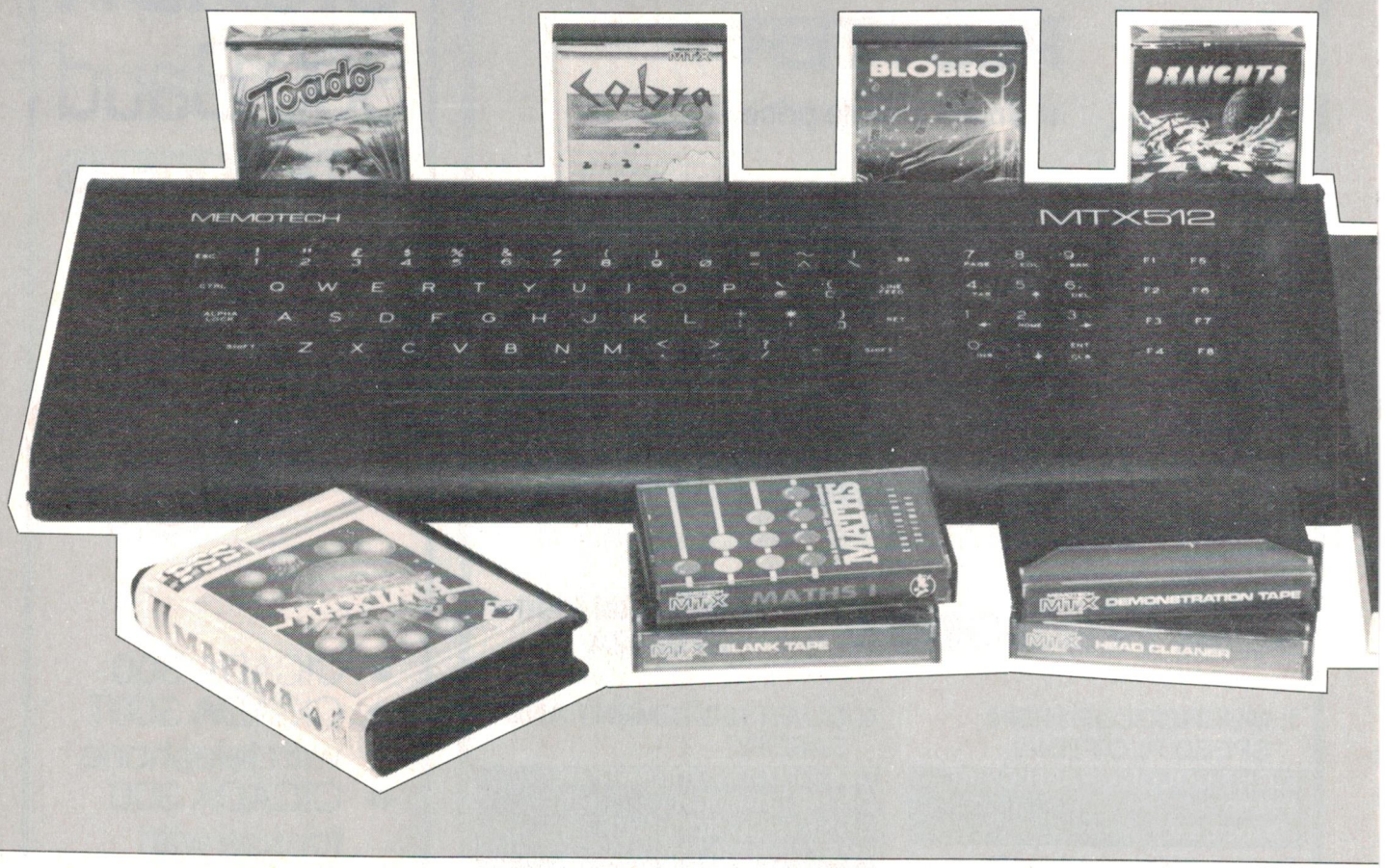


HAVING BEEN programming for several weeks now on the new British-made Memotech MTX500, I still find I am only scratching the surface of the graphics and sound possibilities of this quite compact and very light piece of computing machinery. Manufactured near Oxford in the UK, it is obvious that a great deal of thought has gone into the design of this Z80-based machine.

Available in two models, one has the choice of 32K or 64K (the MTX512) of RAM as standard, with a whopping 512K as the upper limit using optional extensions. This is accomplished by "paging". This facility also allows the MTX to operate in the normal BASIC mode via monitor/interpreter in ROM from address 0000, or in a CP/M mode where RAM occupies these lower addresses. An additional option is 'silicon disks' which are RAM boards that emulate a disk configuration but operate much more quickly. Up to 32 *megabytes* of storage may be obtained using this feature.

A most important attribute of the MTX is that video RAM occupies a separate 16K from that of the user; ie: virtually all of RAM is useable by the operator, a facility not offered by many other economical computers. (This does have a slight disadvantage insofar as making video RAM less accessible).

The microprocessor is a Z80A, operating at 4 MHz. The MTX has been designed with CP/M as a final objective so as to take advantage of the vast quantities of software available. For this configuration one has the option of using either floppies or Winchester disks for mass data storage. At this clock speed, the Z80A of the MTX is somewhat faster than the Commodore 64's 6502 processor in BASIC programs, but not quite as fast as that of the BBC.

Since this computer only appeared on the UK market late last year, and recently in Australia, much of the peripheral equipment is still in the process of being released. However, already there is a range of both hardware and software available including a word processor and an extensive range of games. Although my contact with the word processor has only been short, it seems adequate for most requirements, being based essentially on the popular "Wordstar" format and providing the normal menu-driven editing facilities. As a 'Zardax-ophile', I am hopelessly biased in commenting.

Memotech's version of Frogger, "TOADO", comprises some 8K bytes of assembly language programming. The Chess tape is particularly detailed, taking 105 seconds to load, even at the MTX's very fast cassette rate of 2400 baud. The baud rate is adjusted by POKEing a location in RAM, given by the list of system variables in the manual. (A niece of mine, although unable to beat the machine, was able to extend the MTX games to several hours. A tutorial is also included.)

Graphics use

As a personal application, I have been able to utilise the extensive graphics capabilities in several areas of electronics problems. Multicolour graphics of load line analysis for a transistor amplifier, as well as the circuits themselves, were easily obtained from BASIC by use of such standard commands as CIRCLE, PLOT, LINE. Similarly, using the 100-hour in-built digital clock, I was able, in a few instructions, to program the MTX to display an analogue clock face with the position of the hands being updated each minute.

There are two graphics modes; text and multicolour, which can be controlled via assembly language or the BASIC commands provided. These include the GENPAT command for made-to-order sprites or characters, and others to control their movement.

There are 31 planes on which the sprites can be placed, with a foreground and background plane behind these. It is also possible to control the framing by a VIEW command which controls the window onto

BLACK MAGIC

The Memotech

Lance Wilson

The Memotech MTX500 has enjoyed a successful launch in the UK and is now available here. It has some unusual features not found on machines around the same market price. Worth a considered look.

these visuals. Display control is by a TMS 9918 chip.

With the virtual text and graphics screens which one can set up on the MTX, it is possible to switch between textual and display material under simple program control. Contributing to this ease of interaction is the built-in text handling language NODDY which is also accessed from BASIC. This language operates via virtual text screens, treated as pages which can be called by simple NODDY commands. Possible applications would include programmed learning material, providing text in accordance with response.

There is also the option of changing the character font to various foreign language alphabets.

Sound

Sound capabilities are amongst the best around at the moment. The chip used is the 74689A (three tone channels and one noise), as used in the BBC machine, but MTX BASIC lacks the ENVELOPE command. However, programming sound is far easier than with such computers as the Commodore 64, which has the more powerful SID chip, but a weak interpreter.

Envelopes may be implemented on the MTX, using normal BASIC commands. There are two SOUND commands, one

MEMOTECH REPORT SHEET

Processor	Z80A
Clock	4 MHz
ROM	24K
RAM	32K (MTX-500), 64K (MTX-512)
Video RAM	16K (does not rob user RAM)
Languages	MTX-BASIC (with MTX graphics) NODDY (11-command, easy-learn language) Z80 Assembler
Keyboard	79 keys, numeric keypad and eight function keys
Display	24 lines of 40 characters Up to 16 colours Up to 32 sprite characters
I/O	Cassette port (2400 baud max speed) Parallel I/O port Two joystick ports Audio output Composite video output RF output (for TV set) ROM cartridge port Centronics printer port
Options	Communications board (two RS232 ports). 'Oxford Ring' links up to 255 units. PASCAL and NEWORD (W-P) on ROM (for MTX-512) 80-column colour card RAM expansion to 512K Floppy disk systems: single and twin 500K drives (CP/M, with 80-column colour card, NEWORD and SUPERCALC) Hard disk system: 10, 20 or 32 Megabytes Silicon disk: 256K RAM that operates as a super fast disk
Price:	MTX-500: $699 (32K) MTX-512: $849 (64K)
Supplier	Interfaceware, PO Box 214, Lindfield NSW 2070. (02)46-4374.

with the three parameters of channel, frequency and volume which is useful for slotting any bursts of tone into games programs, for example.

The other command has seven parameters, the additional ones being frequency and volume gradients, plus duration and chaining. With this very functional command and a bit of arithmetic, one may easily string an envelope together. Having recently purchased a piano-type keyboard, I am currently working on having the MTX work as a fully programmable synthesiser.

Since some of the parameter ranges mentioned in the manual seem to be in error, a bit of experimentation is worth trying when using these commands.

Probably the aspect of the MTX that most qualifies it for criticism is the BASIC interpreter, being a somewhat primitive implementation using "LET" in its assignment statements. The number of commands is also rather meagre, (except in the area of graphics), when compared with common benchmarks such as Tandy's Extended Colour BASIC or the regular Microsoft implementation. One command sorely missed is line renumbering. However, a useful programming facility is that the user has the option of entering abbreviated versions of commands. Using Memotech's example:

comes up as if x = 5 t.g.500

IF X = 5 THEN GOTO 500

Manual

The "BASIC Tutor, Reference & Operator's Manual" has a very adequate technical description and explanation for the use of graphics and sound commands but tends to be insubstantial as the claimed "BASIC tutor". The first mistake was probably in the concept of a "combine everything" book rather than segmenting the various sections of the title between three different covers.

By splitting into sections, the task of revising (or even scrapping and rewriting) various areas would have been made easier, to the user's ultimate benefit. This manual does need a rewrite, with more information required on those areas where the programmer can take advantage of the machine's obvious strengths.

For a start, there should be a section on utilising the ROM subroutines and material on directly accessing video RAM from BASIC. Since an emphasis of design has been ease of assembly language programming via BASIC, it seems a little shortsighted not to have provided extensive documentation for its use. But then, manuals with most machines are a whole lot worse.

Nevertheless, it is reassuring to see that in the various UK computer magazines, a substantial amount of independant writing on the Memotech by authors such as Keith Hook (eg: in *Personal Computing News)* has already appeared.

A significant factor in buying a computer should be the quantity of backup literature available and articles by such erudite and knowledgeable writers as Hook are an important aid in getting the most out of any computer. Much of the ageing BBC computer's success has been due to the enormous numbers of books and magazine articles that it has inspired. This can be an important aid in getting the most out of any computer. Much of the ageing BBC computer's success has been due to the enormous numbers of books and magazine articles that it has inspired. This can be thought of as one example of the importance of *software* in choosing a computer. It is this factor (as well as its powerful BASIC) which keeps the BBC from sliding into overpriced obsolescence.

The aforementioned BBC BASIC is a dialect that Acorn wrote for its BBC machine which provides an element of structure and facilities not so far equalled elsewhere in this language. Unfortunately, the BBC is currently somewhat overpriced, particularly in Australia.

Since assembler operates many times faster than BASIC, it is an essential for use with any fast-moving display. Obviously, this immediately means *games* to most of you, but applications graphics that plot anything on the screen in a slow, laborious fashion have limitations. (Ever seen an Apple circuit-drawing program in action? Take your sandwiches).

Black mark to Memotech for not following that same route as Acorn and putting a large effort into BASIC interpreter development rather than only relying on CP/M to provide the wherewithal. It is interesting to note that Ian Sinclair, the famous Clive's brother, has already added the Memotech to his range of introductory books on computer programming.

For the serious

For all the inadequacies of the BASIC, the facilities available for the serious machine-level programmer are *second to none*. It is possible to incorporate assembly language subroutines into BASIC programs by just typing:

ASSEM <linenumber>

at the appropriate stage, keying in the necessary code, and returning to BASIC at the next line.

For debugging purposes there is access to memory locations and registers via the PANEL command, which also incorporates a disassembler to translate the machine code into assembly language. Thus, one is able to write a program just one level away from machine code, assemble it, and check its operation by single-stepping through each instruction, viewing the effect on registers and memory as you go.

It is probably as a *splendid graphics machine* with a powerful built-in assembler that the Memotech achieves top rating over many another computer in the under-$800 price range.

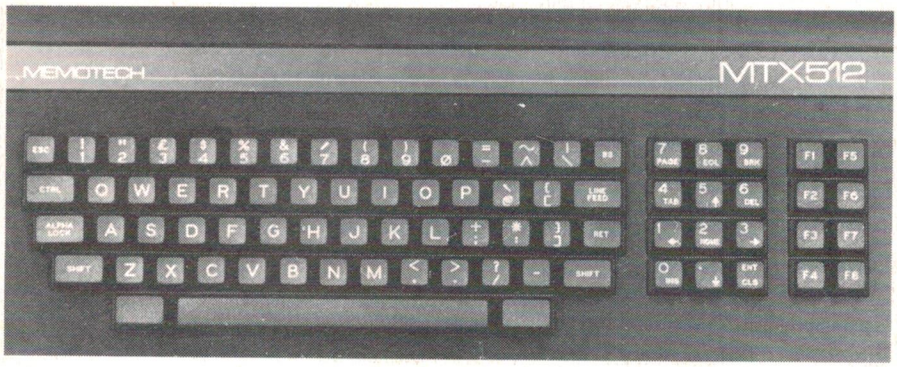
One problem encountered, for which clarification is being sought from Memotech, is that commands for locating code at particular memory locations do not seem to operate as the manual states.

The Memotech, because of its many ancillary facilities such as the Assembler and the PANEL instruction, plus its capacity to be expanded to a full CP/M system, can be recommended to the serious (ie: machine code) neophyte programmer, as well as the businessman looking for a versatile, innovative system.

It is more state-of-the-art as an 8-bit machine than its somewhat cheaper competitors, such as the Commodore 64, Tandy Colour Computer or the Atari 800XL. It is potentially more powerful than those of its competitors with vaguely-defined limitations of compatibility, such as the pseudo-Apple Dick Smith CAT (ie: which Apple software will it run, like Zardex, and what accessories does it need to do it?).

Those in the computer marketing game who are ever ready to push the latest N-bit microprocessor would generally prefer that the customer forget the adage "software first, hardware second". However, CP/M, Apple and to a lesser extent Tandy, Atari and Commodore, are the most prolific sources of applications software (and textbook backup) for those who would have their computer perform useful functions, without extended forays into obscure and difficult programming.

Until the IBMs and look-alike challengers, as well as MSX BASIC machines such as the Spectravideo, have been around for two or three years, they will have a measure of difficulty in competing with CP/M for breadth of available software.



Pascal and beyond

Although the BASIC leaves something to be desired, Memotech has a Pascal option. This language, for the past ten years, has been the darling of academics who have been saying (and saying and saying) that it was the coming innovation that would sweep all other languages away. Since Memotech's implementation has only recently become available I have not had the opportunity to investigate it; hopefully it compensates for certain of BASIC's weaknesses.

Memotech's Pascal comes in a ROM pack, as does their FORTH. Because RAM can be slotted into page zero and the ROM can be extended, it is possible that independant software designers will supplement the interpreter with tape or disk languages similar to Simon's and BC BASIC available for the Commodore 64.

Hardware aspects

The keyboard is of a very high standard, set in a compact aluminium assembly which has the appearance of a professional terminal, similar to those appearing in so many offices these days.

Apart from its pleasing appearance, the black, satin finish has the practical spinoff of a greater heat radiation coefficient, resulting in more efficient cooling, assisted by the aluminium construction.

The MTX is so light and compact that it could almost double as a portable terminal, although the length somewhat precludes this.

A most annoying fault encountered on my particular machine is that certain keys have a degree of bounce if not hit carefully. Thus, "O" as in "LOAD" produces displays such as "LOOAD" or "LOOOAD", resulting in extra effort and concentration being required at the keyboard. Probably this could be eliminated by POKEing a location in RAM to extend the time interval between which the keys are strobed, but such information is not easily available. In other respects the keyboard sets a standard that other manufacturers should certainly follow, convenience being of the *first order*, with divisions of alphanumeric, eight function keys plus a numeric keypad with shifted screen editing functions.

Interfacing to the real world is provided by several ports; although RS232 is not built in as standard, the communications board option provides two of these and is fairly inexpensive.

There are two joystick ports which are wired to the Atari standard; printer connection is via a Centronics port.

There is an independant audio output for connection to a sound system.

One can view on either a TV or a monitor, the latter being via composite video signal; both are easy to read on the 40-column display. RGB output is an option which comes with the 80-column board (100 UK).

Provision exists for mounting the communications board and an extension RAM inside the MTX keyboard chassis Options such as the 80-column board would normally mount within the disk drive cage. A light pen input is also available on this particular board.

Further embellishing the mooted role of terminal is the "Node/Ring System" option which is only briefly detailed in literature accompanying my own machine. Modems and driving software should shortly be available and thus the MTX has prospective applications in office or educational networks, as well as providing communications access.

The price of the Memotech in Australia is about 35% higher than its UK pound equivalent. Not much when freight, duty/tax and the provision of local back-up is taken into account. Thus the Memotech price structure here can be seen to be a very fair one. Although the full CP/M system is not cheaper than equivalent Asian equipment, the MTX has already established a position in terms of the literature available; obviously it will still be around in two or three years when many of its competitors are but a memory.

For a machine costing not much more than half the BBC, *the MTX packs a lot of clout.* ●

MEMOTECH BASIC

Command words

INPUT	ATTR	BAUD	ELSE
LIST	COLOUR	CLOCK	STEP
LOAD	ADJSPR	INK	CSR
PRINT	MVSPR	PAPER	DIM
OUT	SPRITE	EDIT	GOSUB
POKE	CTLSPR	GOTO	LLIST
READ	NODE	IF	NEW
SOUND	GENPAT	LET	ON
PLOT	RANGLE	LPRINT	PANEL
CODE	WINDOW	NEXT	RETURN
OFF	RESTORE	NODDY	SAVE
TO	SELECT	PLOD	DRAW
REM	EDITOR	PAUSE	FKEY
CLS	DSI	RAND	THEN
ASSEMBLE	AANGLE	RUN	CONT
AUTO	SNDBUF	STOP	CLEAR
VS	ARC	VERIFY	DATA
CRVS	LINE	CIRCLE	FOR

Operands

+	/	>	<=
–	↑	<	<>
*	=	>=	

Functions

AND	ASC	PI	SQR
ABS	RND	OR	USR
EXP	NOT	ATN	LEN
SGN	COS	LN	MOD
TAN	INT	SIN	
VAL	PEEK	INP	

Strings

CHR$	RIGHT$	TIME$
LEFT$	INKEY$	GREAD$
MID$	STR$	SPK$

The MTX character set

Aside from the normal character set, the MTX-500 provides fonts for all the special letters and accents used in: English, American, French, German, Swedish and Spanish. However, there is a corresponding loss of certain mathematical and punctuation symbols.

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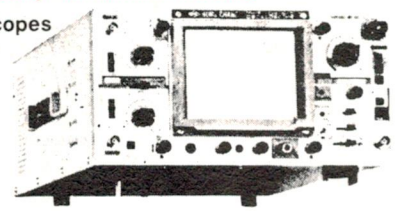

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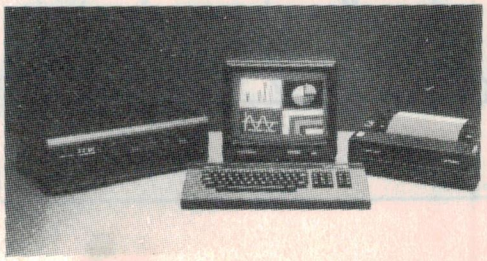

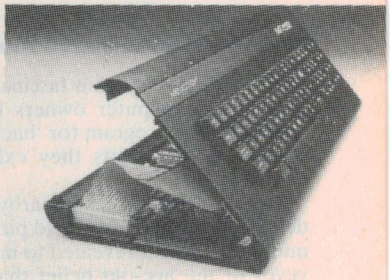

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KNOW YOUR COMPUTER NUT

IT HAS LONG been a fascination of mine identifying computer owners by the environment they program (or 'hack') in and by the personality traits they exhibit in said environment.

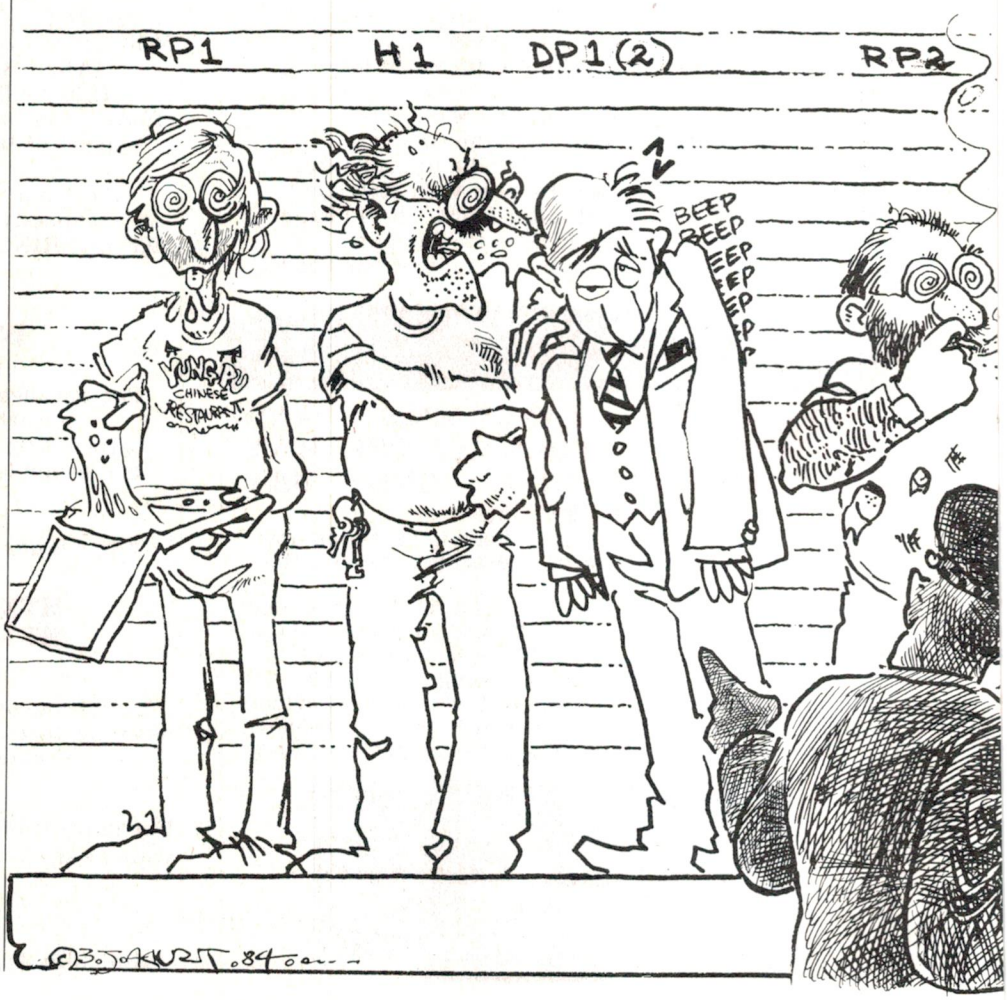
On a recent visit to a nearby system, the decaying stench of week-old pizzas and salami-soaked carpet revealed to me a true purveyor of the age-old belief that *computing precedes all evils*. Interesting to note was the chaste state of the hardware — sparkling clean with listings well filed and disks locked with labels (gasp!) updated. Exhibiting startling contrasts of personality, we shall label this individual "Real Programmer, Class 1", or simply, RP1 (to employ the acronym form, of which computer people are so fond).

Near RP1 I found a hacker of a different nature. Given to arguing a lot, this type, in order to save money, has his system talking via jam tins and wet string over the back fence at 50 baud to a like soul. This individual is totally different and can only be labelled a 'Hacker, Class 1'. A classic case, where hardware is unimportant so long as it works and the disks can't be seen through. He has an introverted nature and won't even speak to the dog lest it asked him a question. But at the keyboard — a *whiz!* His environment is unique. To minimize labour, every peripheral is stacked on top of the other in a room that makes the average broom closet look *huge*. It is specifically designed to house a system and a person. No more. It has about ten locks on the paper-thin door as a safeguard against piracy. The floor is a myriad of old listings, supposedly in a logical order on the Coke-stained carpet, now impossible to see under the pile of footworn paper. The H1 writes machine code at a huge rate, completing a program in two hours flat (regardless of its complexity) and prefers to debug it months later. The software he has sold is never pirated and pays for a box of disks a year. He never smokes or drinks and drives other hackers to suicide with his never-ending borrowing of their magazines.

H1 and RP1 types have only one thing in common: *they wear T-shirts!*

Well-dressed hackers are different. Their system room has a floor unstained but littered with shirts, pants, ties, socks and shoes, invariably strewn over a floor heating vent. The room is normally huge and the air cold. Such individuals crave money and talk of very little else. They can be observed sleeping in computer club meetings pretending to be waiting for someone to employ them on a consulting basis. They normally have pagers which they beep to check if they still work. We shall call this Herbert:'Dressing Programmer, Class 1'.

The DP1 is often confused with the DP2, a man of achieved ambition who also sleeps in strange places. DP2 actually knows things and people. He has a pager which is turned off when he dozes through a monologue.

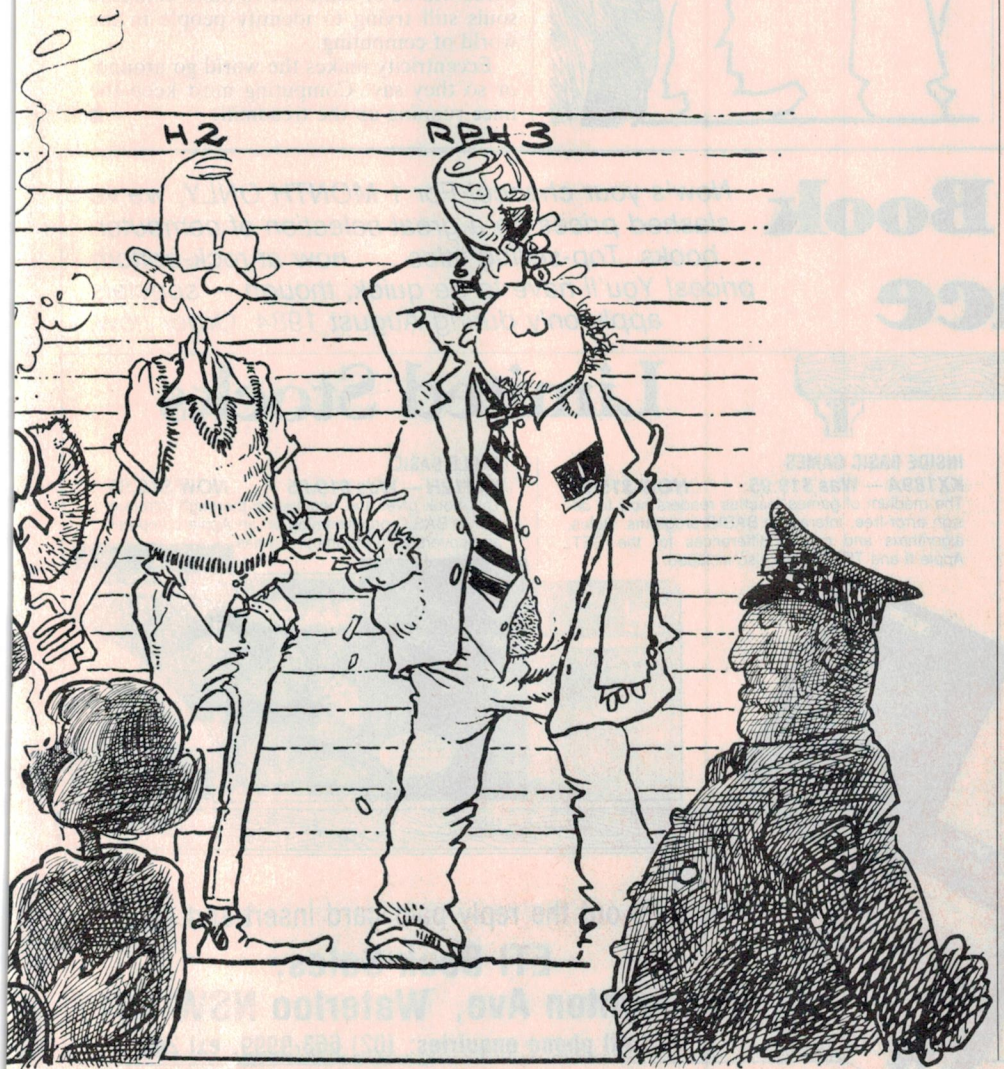


Do you know a 'Hacker, Class 1'?
How about a 'Dressing Programmer, Class 2'?
How do you become a 'Real Programmer/Hacker, Mark 3'?
Here's a humorous look at
the various 'classes'
of that modern phenomenon
— the computer nut!

Nigel Leith

DP1 types emulate DP2 and many clashes occur which the DP1 always loses, causing DP1 to move to yet another computer club with his wealth of sleeping knowledge.

A 'Real Programmer, Class 2' *never* goes to club meetings. He smokes incessantly, wears ties when asked and holed T-shirts when dress is unspecified. The RP2 has a similar system room to the RP1, with notable exceptions. Primarily, there is a closed window, shuttered, inadequate ventilation and a constant pall of smoke in the room. An RP2's cigarette butts are balanced on the table. An RP2 types gently. Finances are dedicated to the system alone, which grows internally to mammoth proportions.



The RP2 enjoys scrapes with the RP1, questions a H1 until he cries, wakes up a DP1 with an illogical statement which the DP1 invariably agrees with, and ignores the DP2 for pure satisfaction. RP2s are rarely sighted as they mainly talk by phone and communicate via modem. When sighted they size up the second party until categorised and take the appropriate action.

An RP2 can be approached by a 'Hacker, Mark 2'. The H2 is a nondescript soul who has been writing code since diaper days. The H2 has a neat room, normally his bedroom, with disks in a magnetic eraser safe should people decide to steal software. He knows all systems, from their clock speed to what type of casters they have, and is a mine of information with low morals. Where the H1 tries to break into computer systems which are well-documented and publicised via a cheap modem, the H2 backcharges OTC 'phone bills to an Australian system previously broken into with a second autodial modem attached to a remote node on the system which the engineers forgot to detach. The H2 normally has a good night when crossing the Pacific many times and closing his system down with all the used systems sending random data to each other and tying up all outside callers.

The H2 scoffs at all and regards anybody's software as public domain because he could write better code anyway. An RP2 is intimidated by an H2 and avoids the haunting hacker like the plague. Upon confrontation, the H2 downgrades the RP2 whilst the latter, exercising a superior wit, attacks all comments with a barbed tongue. An RP2 and a H2 ally only against DP1 types who unwittingly engage in futile conversations on expertise. After such talks, both the H2 and the RP2 leave the room in uncontrollable fits of laughter.

The H2 is normally morally bankrupt, untidy and unkempt. You'll find Coca-Cola bottles and glasses around the keyboard. The H2 prefers tea to coffee. The H2 enjoys $2 dinners and doesn't smoke or drink much. The H2 is often confused with the hybrid 'Real Programmer/Hacker, Mark 3'.

The RPH3 is just as lunatic as the H2 in wit and nature, lapses between H1 introversion and H2 extroversion on occasions and ▶

drinks like a drought-striken fish. The RPH3 has flashes of inspiration which lead to six month-long programming stints which occasionally get finished. The unfinished code alone is *masterful*. The RPH3 is unconcerned with his day job and normally dedicates funds evenly between hardware and wide-ranging alcoholic delights, from apricot wine to diluted methylated spirits.

The RPH3's environment is readily recognised by a glistening, well-lit computer bench, a huge armchair in front of the detachable keyboard and a dull light in a corner overlooking a dusty science fiction novel.

The RPH3 mutilates his alarm clock every morning with great gusto and repairs it by night. On forgetting to set the clock he destroys it anyway for not waking him up. The H2 and RPH3 enjoy destruction and when seen together should be avoided, unless the observer is of a similar status. They intimidate H1s, outrage RP1s, reduce DP1s to tears, frustrate DP2s, force RP2s to violent acts and send all normal citizens into uncontrollable fits of depression and anger.

The RPH3 is only seen by visitation, voids clubs and burns magazines. The RPH3 enjoys music, food and Big M calendars almost as much as sleeping off hangovers. When programming, the RPH3 can carry on a conversation, change a tape,

drink and type simultaneously — with only a slight pause to top up his glass. When sleeping the RPH3 swears and/or rips sheets. When drunk, the RPH3 keeps typing, the phonetics of his typing matching perfectly his manner of speech. Socially, the RPH3 is a spectators' sport only. This individual ignores politics, events, newspapers, radio, comments, womens' faces, hygiene and socks. He is only affected by Hari-Krishna, Jehovas Witness, Salvation Army, Avon or Red Cross doorknockers. These force him to put on dark glasses, ear muffs and an overcoat in order to act blind, deaf and dumb. The knockers give up in fury as he mumbles about fruit bottling from behind the fly screen door.

One can only wonder about computing's effect upon society. Could we be creating a new strain of human or were they here all the time waiting for technology to catch up to them? (Radio amateurs preceded them . . . Ed.)

In possible further articles more wondrous types of computing people will be revealed. But for the time being, I trust this guide will be of some use to those confused souls still trying to identify people in the world of computing.

Eccentricity makes the world go around, or so they say. Computing must keep the mice running up the treadmill. ●

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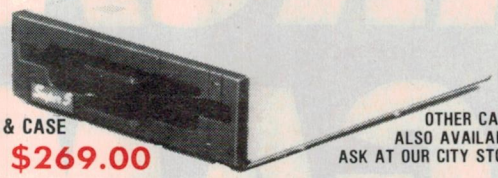

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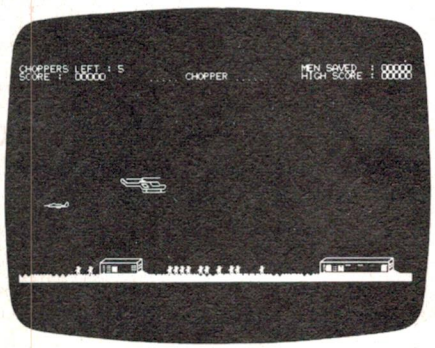


Chopper — a rescue game. You have to rescue the hostages trapped on the ground without getting shot down by enemy jets or air-to-ground missiles. Based on a real life story . . .

BACKin ETI November 1983 we looked at some of the then new games being sold for the Microbee. Most of them made good use of the computer's graphics system based on a programmable character generator (PCG). As the months rolled on many independent software writers learned to put the Microbee's PCG to good use. The result is a crop of new graphics games that have to be seen to be believed.

All the programs reviewed this month are distributed by Mytek of Western Australia, not because they're necessarily better than anyone else, but because they are the ones that I could get a hold of easily. At the moment there's not one computer shop in Hobart supporting the Microbee, so whatever new software comes along is either borrowed from someone or it arrives through the post.

Before getting into the programs themselves, perhaps we should briefly look at how the PCG works. Each location in the screen memory simply contains a pointer to some block of data that the Microbee's character generator accesses to make pretty patterns on the screen. In a normal 'Bee there are 1024 of these points, and the CRT controller chip determines the area of the screen for which each pointer will provide data. Usually there are 64 locations across by 16 locations down.

Microbee has a read only memory chip containing the data the CRT controller needs to make letters, numbers, and punctuations, and this is the one accessed when you are typing away on the keyboard. But if you send to the screen memory any character code higher than 127, it will switch from the character ROM and access the PCG instead. The nice thing about the PCG is that you can record into it any character data you desire . . . italics, inverse video characters, or little squiggly shapes of any description.

A normal character cell is 16 dots high and 8 wide. This is arranged as a continuous series of 16 bytes, with bit 8 of the first byte located at the upper left hand point of the cell. Below it is bit 8 of the second byte, then bit 8 of the third, etc.

The contents of a character cell will appear on the screen at any location where there is a pointer byte asking for it. So if the pointers at the screen's four corners and the one in the centre all contain, say 35, then the contents of character cell number 35 will appear at those 5 locations. Now the beauty of the PCG system is this: if you change the contents of cell 35, what you see at those 5 locations will change as well, simultaneously, all five copies. So if you look at graphics games like kilopede for instance, you'll see things all over the screen changing in unison.

We will refer to the above system as 16 line graphics. But somewhere along the line somebody decided some interesting effects could be had if there were more than 1024 different locations to play with. So they changed the system to allow 2048 screen locations, 64 wide by 32 high. But with the number of dots remaining the same cell could only be eight dots high instead of 16. The extra screen memory was already in the Microbee, virtually unused, so all that was needed was to reprogram the CRT controller chip to the new standards. We'll call this alternative system '32-line' graphics.

The only real problem with 32-line graphics is that the Mixrobee's character ROM is still on the 16-line standard, so there's no longer access to numbers and letters. But the solution is to simply abandon the ROM and program the letters and figures you will be using into 8 x 8 dot character cells, just like graphics characters. Ever wonder why the text in some of these games looks a little 'different'? Mytek's word processor contains its own upper and lower case character set to exploit this technique . . . that's how they get 32 lines of text onto a Microbee screen.

You can't say that the 16-line or the 32-line system is 'better'. Which one is used in a game depends mostly on the shape of the most important characters to be displayed. Now on the games:

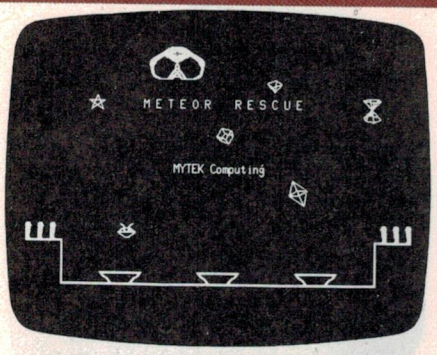
Chopper

Word has it that this one was based on the abortive American attempt to rescue their imprisoned hostages from Iran using a fleet of helicopters. You lift off from your home base in your trusty Jet Ranger and fly out over enemy territory. On the ground below you are the hostages, waving madly for help. You fly on and on as a panorama of buildings sweeps below you; the entire layout being several times as wide as one Microbee screen. You can fly your chopper with either a joystick or the keyboard.

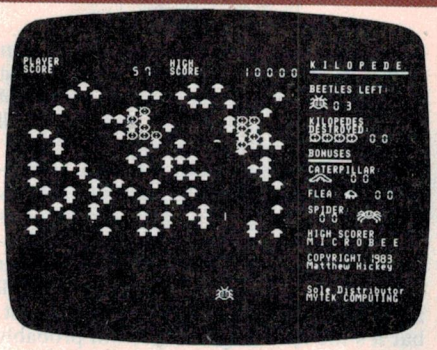
As you fly along, enemy jets attack you and ground-to-air missiles shoot up from below. Contact with either of these results in the demise of your chopper. You can fire back at the planes, or drop brombs on the missile sites. When you find a group of hostages, you land near them and eight of them jump aboard your chopper. You must then ferry them back to base before coming back for more.

The game uses 32 line graphics and

A review of some new arcade-style games using the Microbee PCG. A look at how they work and how you can play.

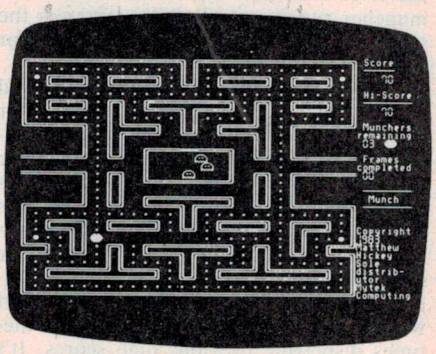


Another rescue game. Take your craft from the mother ship (top left) to the landing pad, pick up a man and return without getting hit by a meteor or missing the docking. Lively graphics on this one.



Centipede invaders! A variation on space invaders; #2074. This is Kilopede. Use your battle-beetle to zap the centipedes, caterpillars, fleas and spiders. Lose — and a big foot comes down to squash you! Seen that in a dingy arcade somewhere . . .

Pack 'em in, chomp em up! Ghost Muncher — a variation on the popular Pac Man. Like Kilopede, this game is very smooth and easy to get along with. And very inexpensive.



the Microbee

Tom Moffat

moves along very quickly. If you think it sounds like pretty good stuff, wait until you see the same thing on an Apple or a Commodore 64. The chopper moves with inertia as would a real one, and as it moves forward it drops its nose in the usual way, allowing you to shoot things on the ground with your forward cannon. And when your chopper is full, the remaining hostages wave goodbye to you. Now that's real class! But they use a lot more memory and cost up to three times the price of the Microbee version.

Chopper is the kind of game that will impress the hell out of people, especially non-computer people, when they first see it. But, if you're like me, the newness will wear off and you'll soon tire of it. In that case it's probably better that you paid $20 instead of $65, and the game is still there if some non-believer needs impressing.

Meteor Rescue

This program is based on a similar arcade game. It's another rescue operation like Chopper above, but there's a little show built in that will delight the kids.

At the top of the screen (see the picture) is a mother ship containing a rescue landing craft. On the surface of a planet, (or is it a meteor?), are two platforms, each with three little men awaiting transport to the mother ship. You guide the landing craft down through a cluster of spinning geometric shapes (like in the Asteroids game) to the three landing pads below. If you hit an object, or miss a pad, you blow up with a most frightful noise.

When you succeed in landing, everything stops while one of the men moves forward onto a little lift that lowers him down to the landing pad level. He then trots over to the rescue ship and climbs aboard. During the journey back to the mother ship the space objects again threaten, but now you can fire at them and blow them away. If you fail to accurately re-dock with the mother ship, it's curtains once again.

The attraction of Meteor Rescue is much like Chopper. It's got good lively graphics (16-line), and that clever little show as the lift lowers the people to the ground. But as for sitting in front of the computer for hours playing it, well . . .

Kilopede and ghost muncher

I'll treat these two as a pair, because that's the way they're being sold . . . two for the price of one. Both are written by Matthew Hickey and they're very similar in appearance. Kilopede is the arcade game 'Centipede' and Ghost Muncher is an implementation of 'Pac Man'. Both use 32-line graphics.

In Kilopede, centipede-type objects stream down through a field of mushrooms, and you control a little battle-beetle at the bottom. He does the shooting. As you blast away at the marauding centipedes they split apart, turn into mushrooms, or sometimes turn into longer centipedes made up of individual cells. If you hit the first of a string of them the rest follow to oblivion, a wholly satisfying experience for the beetle.

As your score increases other baddies appear . . . caterpillars (that look more like boomerangs), fleas, and spiders. The fleas drop down the screen leaving a trail of mushrooms, and you can sometimes get below a flea and shoot it for points. If you're not quick enough, you die. The spiders bounce along the bottom of the screen and you must get under them to exterminate them, otherwise you die. If any bits of centipede make it to the bottom of the screen without you getting them first, you die. Your death comes straight out of a Monty Python film: a big human foot that goes "squash"! Too bad there's not the appropriate sound effect to go with it.

Ghost Muncher is pretty well classic Pac Man, although with power steering. As you move around the maze, you don't have to hold keys down, you just touch one to change direction. Your muncher never stops except when he gets stuck up against a wall; a technique you can sometimes use to attract monsters before you go on the attack. When you eat a "power pill" they become sedated and you can chomp away at them until they revert. Each monster destroyed from one power pill gives twice the score of the one before, so it's to your advantage to try to get them grouped together near your before eating the pill.

Kilopede and Ghost Muncher are good illustrations of the use of the Microbee's PCG. In Kilopede there is only one character cell describing the shape of a mushroom. But mushrooms appear all over the screen, at each place the screen memory points to "mushroom". If you changed the data in the PCG and turned the mushroom shape upside down, every mushroom on the screen would be upside down.

Likewise there is only one centipede shape, sometimes appearing on the screen as a single cell, or strung together to form a complete centipede. But every screen location pointing to "centipede" shows the same shape. The program can move the centipede around by erasing cells in one ▶

screen location and re-writing them in another.

Ghost Muncher works in the same way . . . the monsters may move anywhere on the screen but they all look the same. The muncher running around the screen is the same as the one on the sidelines waiting for action.

Both these games are very smooth and easy to get along with; a credit to their author. I've never heard of this Hickey fellow but his programs published so far have real class and elegance. Maybe Mytek is under-selling him at $10 a program. There is one fault in them . . . they disappear when you turn the computer off. Most Microbee software takes advantage of the battery-backed memory, so the programs restart when the computer is switched on, sometimes displaying previous high scores. It's also convenient when you want to leave a game in the computer for the kids.

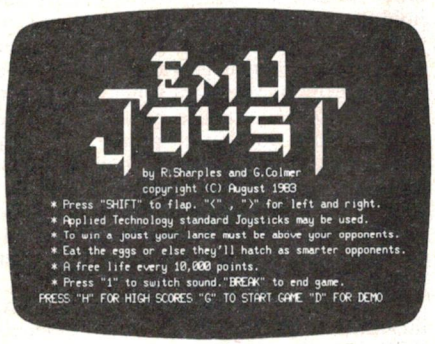
Emu joust

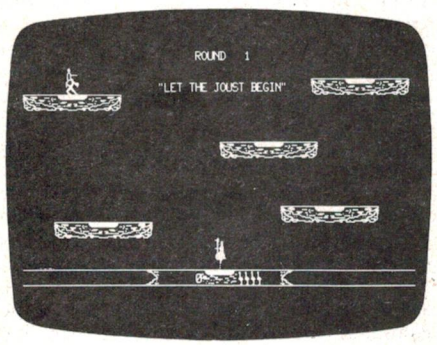
A strange one, this. A floating shoot-em-up game in the Kingdom of Nordrill, again based on a standard arcade game. You control a flying emu, complete with rider and lance. You can move left and right, and up the screen by 'flapping' you wings. If you stop flapping you sink down again. The emus sort of dissolve onto the screen from the centre of platform. The picture with this article shows an emu 'forming', Once you are complete you move around bumping into the dreaded Vulture Knights of Drass. Whoever is higher on the screen wins the joust. If you lose you die. If the vulture loses he turns into an egg which you then squash for points.

The graphics behave in a very unusual way. Every movement takes time to get going, and more time to stop. In other words, everything has inertia, making what sounds like a trivial game into a real test of skill. Even the eggs bounce when they fall off a platform onto the ground.

Emu Joust is slow, although hard to master because of the floating motion. Mytek bills it as 'relaxing'. It's one of those games where you find yourself applying body English to make things move the way you want them to. It's not guaranteed that you'll immediately fall in love with Emu Joust, but it's the kind of game that will probably have a devoted band of followers.

One interesting mode of play is to get the emu down to the lowest level and then just sit back and watch. Eventually vultures will join him there, and since they're all on the same vertical level, all jousts are draws. So the participants simply scuttle around prodding each other in the backside with their lances, which is worth a few laughs. But if you 'flap' at just the right time you'll knock about three vultures over in one hit.





Star striker

It's Star Wars! That's what my five year old son said when he first saw Star Striker running. And it's exactly the impression the program is trying to get across.

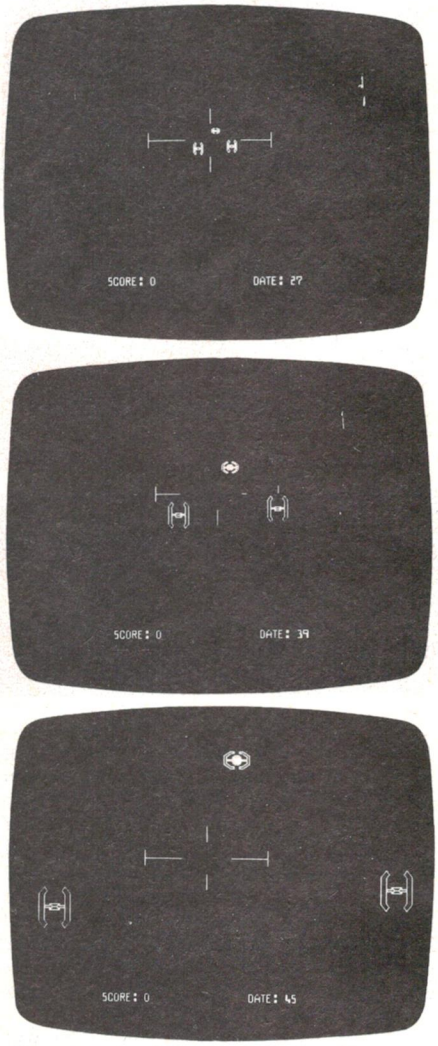
In Star Striker you are inside the program, looking out (shades of TRON —). The screen is the window of your starship; at its centre are crosshairs. You go screaming through a cloud of stars, hunting down and blasting the ships of Darth Vader's fleet.

When I first saw the program I asked, "Is that all it does?" But then it sort of grows on you. Like one night when I was researching this article. A Tangerine Dream record playing on the stereo. One hand was wrapped around a stubby and the other around the joystick. The cockpit lights lowered and the amber monitor softly glowing with images of Darth's battle cruisers dropping like flies; ZAP-ZAP-ZAP!

With your joystick (or keyboard) you are actually flying your craft, with the clues to its attitude and position coming from the stream of stars you're flying through. The joystick controls their path, and the illusion is of you moving through the stars, instead of them moving past you.

On one occasion I noticed that it seemed easier to shoot enemy ships if my own ship was spiralling slightly downward and to the right. But as I stared at the screen I developed a slight feeling of nausea and dizziness . . . the damn thing was making me airsick!

Star Striker uses animation techniques to produce a very fast illusion of enemy ships approaching or receeding from your own ship. The series of three pictures with this article show the screen appearance over a period of about a tenth of a second. In that time, three enemy ships appear, move closer, and then move nearly off the screen. Eventually, after the game has been running for awhile, one of the enemy ships will not move away, but will try to ram you. You have a split second to dodge it; I've never yet succeeded. When the collision occurs the screen erupts in a blinding flash, the computer beeps, and then you get a real let-down message: GAME OVER.



Phantoms ahead! Three screens from Star Striker, about 1/30th-second apart, illustrating the animation technique employed.

This review can't even pretend to mention every rule or feature of every game; it only tries to show you what the state of the software art is at the moment, and explain how some of the games produce the stunning pictures they come up with.

Perhaps we're all getting a big jaded. This latest crop of games software is really quite magnificent but I just can't bring myself to rave about them. We've seen it all before, in the arcades and on other people's computers. We really need something completely new, but what? I've talked to some of the young computer whizzes around the place . . . asked them what sort of stuff they would write if they had access to the ultimate computer. Nobody's got any fresh ideas. Not a cracker. I haven't got any ideas. Have you got any ideas? If so, go for it! *The market is ready and waiting.* ●

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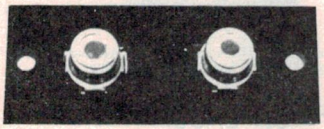

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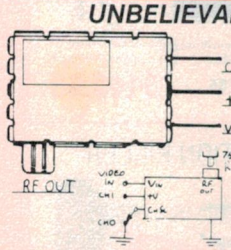

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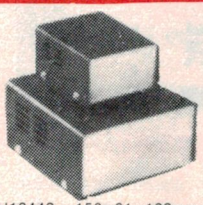

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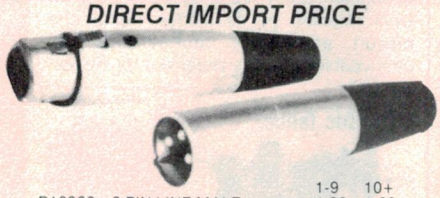

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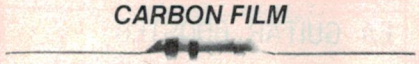

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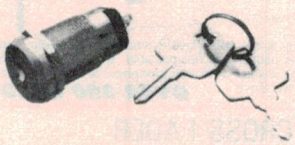

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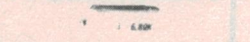

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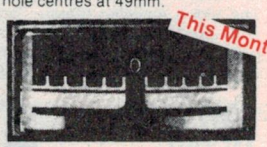

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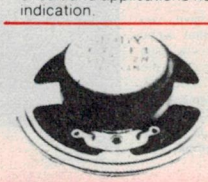

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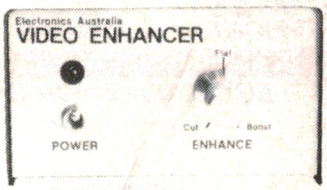

Like tone controls in a hifi amplifier, touch up the signal with this Video Enhancer.

EA OCTOBER 83

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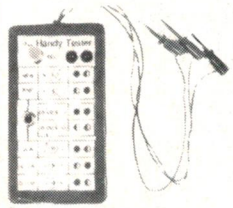

Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester.

EA SEPTEMBER 83

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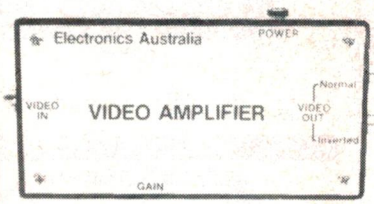

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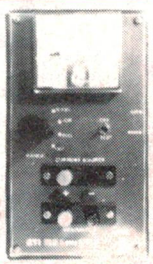

How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. **ETI 158 November 81**

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Essential for the home handyman the Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces as well as locating pipes and wiring buried in walls.

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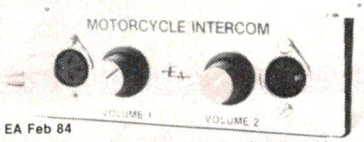

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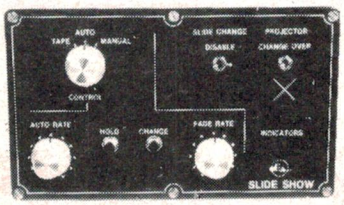
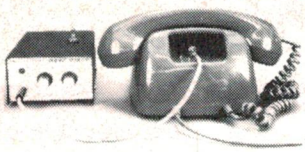


PHONE MINDER $25

EA Feb 84



Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or can perform either function separately.

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EA July 1983

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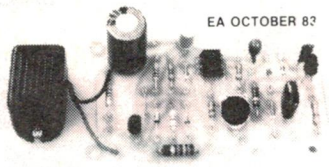

EA OCTOBER 83

Paying speeding fines can be a painful business. Build this Speed Sentry and avoid further pains in the wallet.

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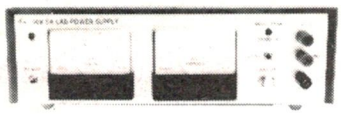

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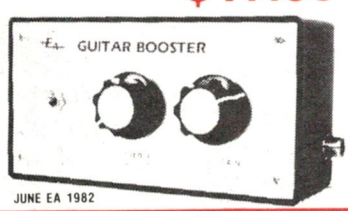

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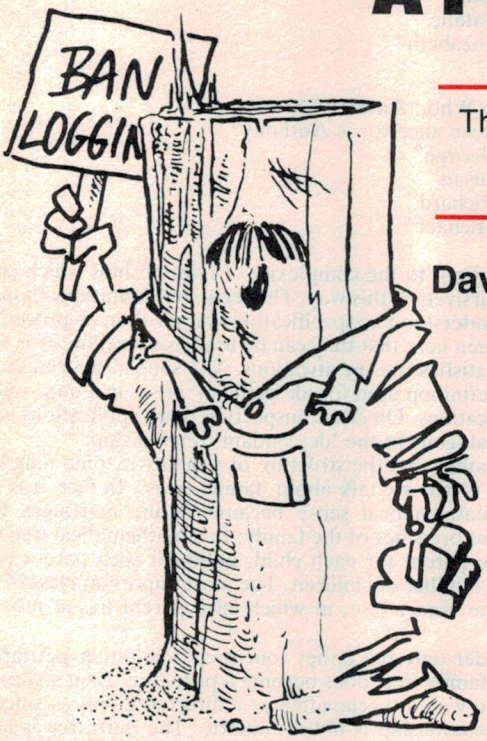
PART 2

PROLOG

A Programming Language



This article consolidates the basic framework of PROLOG. It employs some familiar examples to illustrate the use of recursion in PROLOG.

David M. W. Powers

Dept of Computer Science
University of New South Wales

COMPUTER BUFFS, programmers and initiates may have wondered about the total lack of control structure in the language as described in Part 1. The observation is valid, but it is not an omission on my part; logical relationships need no control structure since they are merely descriptive.

While certain devious in-built predicates provide side-effects which can be used to guide the search and avoid fruitless paths, the fundamental truth about PROLOG is that it is the responsibility of the system to find such paths that lead to a solution. Later, however, we will see some examples where PROLOG appears to abrogate that responsibility.

How then can PROLOG do the sort of tasks normally done in programming using (if we are assembler hackers) jumps and conditional branches, or (if we are Fortran or BASIC users) 'if' and 'goto' statements, or (if we are disciplined PASCAL or ALGOL programmers) 'repeat', 'while' and 'case' statements? Can PROLOG handle the full range of computing problems? Or, in theoretical terms, does PROLOG have the power of a Turing machine?

GOTO CONSIDERED IMPOSSIBLE

Readers may not be aware of the debate sparked by the letter, "The Goto Statement Considered Harmful", written in 1968 by E. W. Dijkstra to the editor of Communications of the ACM (March 1968, Vol 11, No 3, pp 147-8). Although this was not the first recognition that usage of the 'goto' correlated negatively with program 'quality' and Dijkstra refers to such observations as having been around for a number of years, this letter does seem to have been the seminal contribution on the nature of the statement.

Dijkstra points out that people are best at comprehending static relationships, while they are poor at visualizing temporal relationships. His letter expounds the view that the spatial analogue of the temporal progress of a process is important to human understanding, and points out that, for 'goto-less' programs, two 'action descriptions' which are successive in the program text, i.e: in space, are also successive in execution sequence, i.e: in time.

Where an 'action description' is actually a procedure, it may either be regarded as a unit, or examined as a separate textual and temporal sequence of 'action descriptions', our place in the original sequence being remembered (in this latter view). In the case of a conditional statement, a particular 'action description' either is or is not executed (according to the truth of the condition). This obviously does not affect the spatio-temporal correlation. This cannot be said of a branching statement.

'Logic programming' is an approach fundamentally different from the traditional sequential 'von Neumann' methodology. In a pure logic programming program, the sequence of operations is theoretically irrelevant. What is important are the logical relationships. A series of goals to be satisfied must all be simulataneously satisfied for a set of bindings to comprise a solution. What order the goals are satisfied in is, strictly speaking, or no consequence. What is important is that the goal and its bindings satisfy the relationships of the matching predicate.

This corresponds with the 'Structured Programming' view that a procedure should have well defined 'before' and 'after' specifications (pre-condition and post-condition). Thus the relationship between predicate and procedure is more than just the notational resemblance. There is a difference, however, and that is that there can be no distinction between 'before' and 'after' with respect to a predicate — the only difference, if a goal is satisfied, is that more variables may have been instantiated.

Thus we have seen that sequence is essentially irrelevant in logic programs. Unfortunately, for the moment at least, we are limited to using conventional sequential machines which can do only one thing at a time. For this reason PROLOG does have a particular search sequence defined. It uses a depth-first, top-down, left-to-right evaluation sequence. This is about the simplest algorithm for us to understand, and it results in the PROLOG system backtracking in a stack-efficient way.

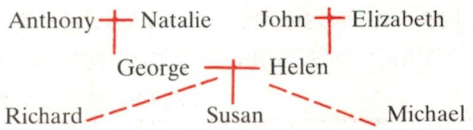
In this context, a construct like 'goto' is completely meaningless. It is impossible in PROLOG for much the same reason as it is abhorrent to structured programmers; it is incompatible with the imposition of logical conditions on program units.

It is, in fact, quite hard to see how this class of control structures, the iterative and sequencing control structures, could be carried over into PROLOG. Later we will see how some of them can be simulated in PROLOG, but they are unnecessary, and a hindrance to clear thought and analysis of the problem.

Given the pure definition of PROLOG as a logical expression of logical relationships, how could you jump from the middle of one implication to the middle of another? On the other hand, it is natural to use the same relation several times in the process of reducing a complex goal to a simple one which can be handled directly. Thus in PROLOG, since the branching constructs cannot even be envisaged, recursion becomes the sole repetitive technique.

The extended family — descendants

Suppose we consider the family tree database example given in the panels, FAMILY TREES — examples and FAMILY TREES — exercises, in Part 1. We have the following family tree:



No. 4 in the panel, FAMILY TREES — exercises, posed the problem of defining a predicate to express 'ancestor' and 'descendant' relationships. This is actually the one relationship from two perspectives, so once one has been defined, the other can be defined analogously, or can be defined trivially in terms of that complementary relationship. Since 'child' has been defined ('fam.4'), descendant can be defined simply.

First, we must decide what a descendant is. Well, a descendant of someone is either his/her child, or grandchild, or great-grandchild, or great-great-grandchild, or . . . In other words a descendant is either a child, or a child of one's descendant — or looking at it another way, a descendant of one's child. Or looking at it yet another way, an ancestor and his descendant may be separated by a single generation (if they are parent and child), or by several generations (if there is a grand- and perhaps a great- or so in their relationship). In the latter case, one can either start from the descendant, and consider his lineage, ancestor by ancestor back through the ages, or we can start from the ancestor, and consider his progeny, descendant by descendant through the generations.

In PROLOG these respective alternatives are expressed

```
descendant(Anc, Desc) :- child(DParent, Desc), descendant(Anc, DParent).
```

or

```
descendant(Anc, Desc) :- child(Anc, AChild), descendant(AChild, Desc).
```

These implications are applicable whenever the relationship between the ancestor and descendant is not simply that of parent and child. In this latter case, the people found by 'child' as satisfying DParent would actually include Anc himself — and he is not his own descendant and thus 'descendant(Anc, DParent)' will fail! Similarly for AChild = Desc: he is not his own ancestor! Thus neither of the above rules is applicable.

These implications are only useful for bridging a generation gap! Examine them and satisfy yourself that they are always true. Paraphrase them: "A descendant of Anc is Desc if . . .". They are patently true, are they not? They are even true for the parent and child case, although they are not applicable since one of the conditions cannot be satisfied — in each case, the recursive 'descendant' condition.

How then do we handle the parent and child case? Simply:

```
descendant(Anc, Desc) :- child(Anc, Desc).
```

In general, in recursive definitions there will be one (sometimes more) simple rule (either a fact or an implication) which describes the simplest case, and has the effect of stopping the recursion. It thus provides a termination condition. In this case, the termination condition is "if a child of Anc is Desc". In some cases, no explicit body of conditions is necessary, as the condition imposed on the predicate by its unification (with a rule in the form of a fact) suffices alone. We'll see some like this shortly.

For now, let's see some examples involving the 'ancestor' and 'descendant' definitions:

fam.6)

```
:-      % Generation rules.
:-      %
:- descendant(Anc, Desc) :- child(Anc, Desc).
:- descendant(Anc, Desc) :- child(Anc, ACh), descendant(ACh, Desc).
:- ancestor(Desc, Anc) :- descendant(Anc, Desc).
```

fam.7)

```
:- ?- ancestor("Susan", Who).
:-      % Who is an ancestor of Susan?
   Who = "George"
   Who = "Helen"
   Who = "Anthony"
   Who = "John"
   Who = "Natalie"
   Who = "Elizabeth"
```

fam.8)

```
:- ?- ancestor(Who,"Anthony").
:-      % Whose ancestor is Anthony?
   Who = "George"
   Who = "Susan"
   Who = "Richard"
   Who = "Michael"
```

There is no limit to the complexity of relationships which can be described recursively in this way. The recursive definitions should be written and understood as specifications rather than as procedures, but we have seen here that they can be used as procedures for establishing what satisfies the specifications. The simple two-clause form of recursive definition used for 'descendant' arises in a huge number of other applications. On closer inspection these applications can be seen to be analogous to the 'descendant' relationship.

First, remember that the structure of a family is something like a tree — which is why we talk about 'family trees'. In fact, it is not a tree in the mathematical sense because of the marriages which merge different branches of the family. In a mathematical tree there is but a single parent for each child, although each parent can of course have a number of children. The most important class of trees is probably the binary tree, in which each parent has at most two children.

If we consider only the father (our society is rather patriarchal, after all) the 'family tree' does become a pure tree. As it stands, the full family tree would be classified as a directed graph — since the parent-child relationship is not symmetric. The pure tree is also a directed graph. One has a fundamental choice, in either case, of pursuing a line of descendants (down the tree) or a line of ancestors (up the tree). Note that a tree has a 'root' at the top, being the ultimate ancestor of every 'node' in the tree, and that the 'branches' hang down from it. This is somewhat different from the way God grows his trees — we draw ours upside-down! The nodes which have no descendants are called 'leaves' and the other nodes are called 'interior nodes'.

Trees are intrinsically recursive structures, since every node is either a leaf, or the root of a 'subtree'. A subtree is simply a tree which is part of another tree. Thus our 'parent', 'child', 'ancestor' and 'descendant' predicates will apply to any tree, whatever the nodes may be, since 'descendant' will descend through the successive subtrees of a node, and 'ancestor' will ascend towards the root, just as if searching for such relatives.

More generally, these predicates will work to find a path between two nodes in any non-cyclic directed graph. They can, for example, find or check a route between any two points in a maze of one-way streets. The non-cyclic condition means that there can't be any way of getting from one node back to itself. If there is, then there is the possibility that PROLOG will run around and around in circles without realizing it — like people often do when in mazes which happen not to have this particular property. If the graph weren't directed, there would always be the possibility of immediately doubling back upon oneself.

Here is a plan of the City of Sydney in the year 2001: ▶

So let's look at how we would design a computer service to guide

us around Sydney 2001. You should be able to recognize that 'street' corresponds to 'child', and 'route' to 'descendant', in the following program. It is entirely the same story as before — only the names have been changed . . . to numbers (or traffic lights). Note that the introduction of an extra data field, the street name, does not affect how the recursion works. Note too that the closure of Market St between Castlereagh and Pitt (along with the choice of the 'one-way' direction of each street) has resulted in an acyclic directed graph.

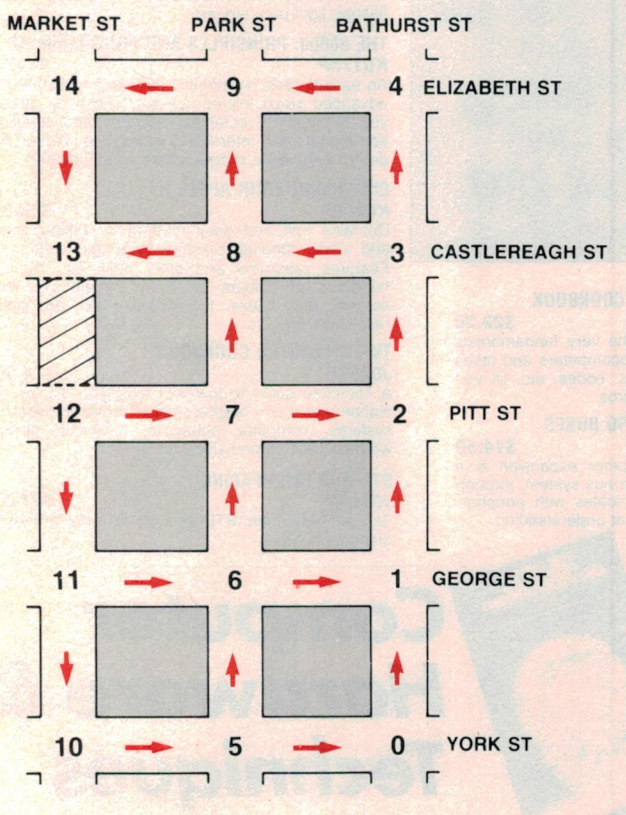
Here then is the guide service:

syd.1)

```
:       % The map.
:       %
: st("Bathurst",0,1). st("Bathurst",1,2).
:       st("Bathurst",2,3). st("Bathurst",3,4).
: st("Park",5,6). st("Park",6,7).
:       st("Park",7,8). st("Park",8,9).
: st("Market",14,13). closed("Market",13,12).
:       st("Market",12,11). st("Market",11,10).
: st("Elizabeth",4,9). st("Elizabeth",9,14).
: st("Castlereagh",3,8). st("Castlereagh",8,13).
: st("Pitt",12,7). st("Pitt",7,2).
: st("George",11,6). st("George",6,1).
: st("York",10,5). st("York",5,0).
:
:       % The possible paths.
:       %
: path(From, To) :- st(St, From, To).
: path(From, To) :- st(St, From, Q), path(Q, To).
```

syd.2)

```
: ?- path(12,3).
:       % Can you go from Pitt & Market to Bathurst &
        % Castlereagh?
** yes
** yes
** yes
** yes
** yes
** yes
```



FGCS, MITI, ICOT, KIPS and LIPS
Fifth generation computer systems

Japan, 19th October 1981. At an international conference it sponsored on Fifth Generation Computer Systems (FGCS), the Ministry of International Trade and Industry (MITI) announced a new national initiative — a project to develop the 'fifth generation' of computer for the 1990s.

14th April 1982. MITI, in association with eight major computer companies, formed the Institute for New Generation Computer Technology (ICOT), launching a 10-year project to develop hardware and software systems to meet the computer needs of the next decade.

May 1982. ICOT published their goals and plans in the report "Outline of Research and Development Plans for Fifth Generation Computers" — the FGCS are now firmly targeted as Knowledge Information Processing Systems (KIPS).

To produce their KIPS, the MITI/ICOT FGCS project is attacking three main frontiers.

(1) The conventional central processing unit is to be replaced by problem solving and inference machines based on concurrent processing elements (this is where PROLOG enters the picture).

(2) The traditional primary, secondary and virtual memory systems are to be oriented towards knowledge base management (cf today's 'fourth generation' computer languages and relational databases — this is an obvious application for PROLOG).

(3) The standard Input/Output interfaces are to be upgraded to intelligent and natural communications, including human language, speech and picture processing (cf today's Artificial Intelligence research — this is currently a primary domain for PROLOG).

To focus on PROLOG; PROLOG uses a technique known as resolution to replace a goal by a number of new goals by employing a matching rule. This technique, whose principle was well known to Socrates and Plato, is known as a syllogistic inference step, or simply as an inference. PROLOG systems (and other deductive systems) may be rated in terms of the number of Logical Inferences Per Second (LIPS) they can perform.

Today micros, minis and mainframes clock in at about 100, 1000 and 10 000 LIPS respectively. The proposed KIPS will perform 100 to 1000 MLIPS (where MLIPS = Mega-LIPS = Millions of LIPS). Even the fifth generation personal computers are envisaged as being in the Mega-LIPS range.

References

(1) T. Moto-oka (ed), 1981, *Proceedings of the International Conference on Fifth Generation Computer Systems*, JIPDC/Springer, Tokyo, Japan, October 1981 — the original announcement on FGCS.

(2) ICOT, 1982, *Outline of Research and Development Plans for Fifth Generation Computer Systems*, JIPDC, May 1982 — the official desiderata for FGCS.

(3) T. Moto-oka (ed), 1983ff, *New Generation Computing: An International Journal on Fifth Generation Computers*, Tokyo, Japan, July 1983ff — an entire journal on FGCS.

(JIPDC is the Japan Information Processing Development Centre.)

syd.3)

```
: ?- path(X,5).
:       % Whence can you get to York & Park?
  X = 10
  X = 12
  X = 11
```

syd.4)

```
: ?- path(8,X).
:       % Where can you go from Park & Castlereagh?
  X = 9
  X = 13
  X = 14
  X = 13
```

Comprehensible! Good! (If not go back to the discussion of 'descendant' and read through again.)

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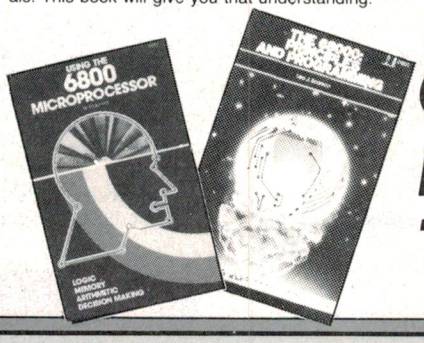

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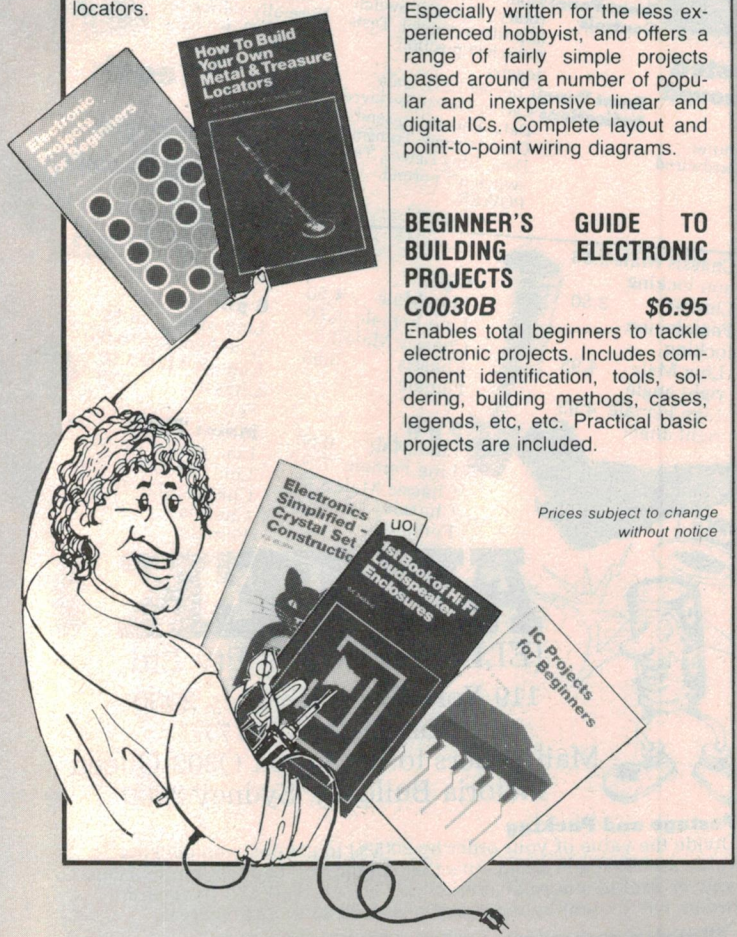

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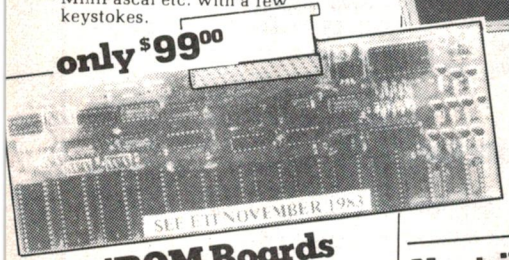

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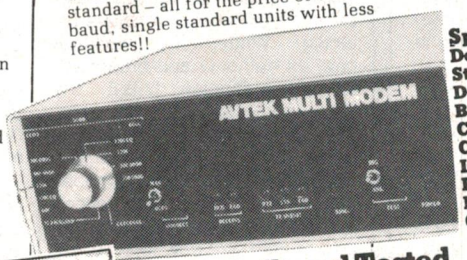

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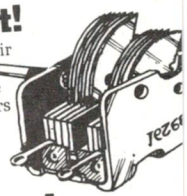

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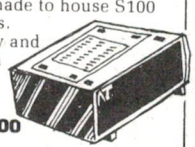

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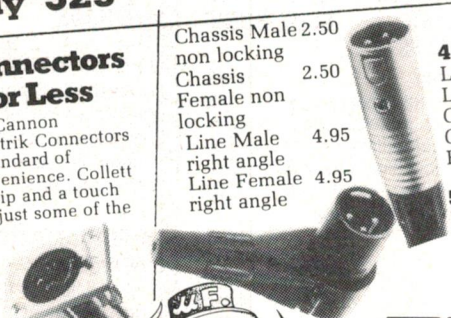

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A.C.T.

ACT Micro 80 Users Group, Bill Cushing, 10 Urambi Village, Kambah 2902. (062)31-3630.

ACT VIC-20 Users Association, Chris Groenhout, 25 Kerferd St, Watson 2602. (062)41-2316, Meetings first Monday of each month at Boy's Grammar Scout Hall, Red Hill, 7.30 pm.

ACTARI, Chris McEwan, Co-Ordinator, ACTARI, P.O. Box E112, Canberra 2600. (062)88-7861.

Apple User Group (ACT), Jeff Brock, 1 Buckley Circuit, Kambah 2902. (062)31-3630.

Australian ZX80 Users Group (AZUG), David Brudenall, 19 Godfrey St, Campbell 2601. For ZX80/Microace Owners.

Canberra ACT Sirius User Group, Jim Bland (062)81-2824, (062)81-2832.

Canberra Compucolor Club (CCC), Meets 7.30 pm on first Sunday of every month at the offices of Digital Equipment, 28 Lonsdale St, Braddon ACT.

Canberra Microbee Users Group, Hugh Gibson, Microbee Store, Level 1, Cooleman Court, Weston 2611. (062)88-6384.

Canberra Microbee Users Group, Adrian Van Wierst, 9 McGowan St, Dickson. (062)49-7030.

Canberra Micro-80 User Group, Milt Cottee, 33 Crawford Cres, Flynn 2615. (062)58-8822. Meetings third Monday each months 7.30 pm in the small theatrette, Reid TAFE, for System 80, TRS-80 etc.

Canberra Osborne Group, c/o Geoff Cohen, P.O. Box 136, Kippax 2615. (065)54-7608.

Micsig, Registrar, P.O. Box 446, Canberra 2601.

N.S.W.

Albury-Wodonga Dist. Microbee U.G., Eric Eulenstein, 202 Kooba St, Albury 2640. (060)25-1601.

Apple Users Disk Exchange Club, Peter Lapic, 45 Malabar St, Canley Vale 2166.

Apple Users Group, Colin Rutherford, P.O. Box 505, Bankstown 2200. Meets 6.30 pm second Monday of each month (Tue. after pub. hol.) at Sydney Grammar School, Stanley St., Sydney. (02)520-0926.

Atari Computer Enthusiasts, Tony Reeve, P.O. Box 4514, Sydney 2001.

Ausborne, Brian Carney, 477-4492, P.O. Box C530 Clarence St., Sydney 2001. Meetings third Wednesday each month at 6.30 pm in the North Shore Council Chambers, for Osborne users.

Ausbug, Stephen Ford, P.O. Box 62, Londonderry 2753.

Australasia ZX80 Users Group, Tony Mowbray, 87 Murphys Ave., Kieraville 2600. (042)28-5296, for ZX80/81 — Microace owners.

Blue Mountains Microbee Computer Club, Roger Cooper. (047)58-7238.

Blue Mountains Computer Club, Eric Lindsay or T. Macindoe, C/- P.O. Faulconbridge 2776.

Broken Hill Microbee Users Group, Peter Cotter, 533 Radium St, Broken Hill. (080)88-1621.

Central Coast Apple Users Group, C. W. Lee, 662 The Entrance Road, Wamberal 2260. Meetings first Tuesday each month at the Niagara Park Public School from 7.30 pm. (043)84-3419.

Central Coast Computer Club, Max Maughan, P.O. Box 36, Ettalong Beach 2257. (043)24-2711. First and third Tuesday every month at Applied Technology, West Gosford, for all types of computers.

Commodore Users Group, John Guidice, G.P.O. Box 4721, Sydney 2001.

Compucolor Users Group, Tony Lee, 52 Cowan Road, St. Ives 2075. (02)449-8824.

Cumberland Computer User Group, S. O'Neil, (02)682-3851.

DEC Personal Computer Special Interest Group, Marion Rhydderch, DEC Australia, Northern Tower, Chatswood Plaza, Railway St, Chatswood 2067. (02)412-5252.

A.P.F. Users Group, Norm McMahon, 288 Kissing Point Road, Turramurra 2074. (02)44-2645.

Hawkesbury Microbee Computer Club, Bruce Rennie, (045)67-7329.

HP Desktop Computer Users Group, Dr R. W. Harris, CSIRO Division of Mineral Physics, PMB 7, Sutherland 2232. (02)543-3460.

Hunter U. G. — All Microcomputers, Secretary, P.O. Box 39, Broadmeadow NSW 2298. Meets on the second Wednesday of each month in Room 308, building W, University of Newcastle at 7.45 pm. Membership is primarily Apple II orientated, but anyone with interest in micros welcome.

Illawarra Microbee Computer Club, Ronald Read, 49 Beatus St., Unanderra 2526. (042)71-2384.

Illawarra Super 80 Users Group, Jim O'Grady, Chairman, P.O. Box 1775, Wollongong 2500.

Kaypro Users Group NSW, Harry Richards, 4/2 Bortfield Drive, Chiswick 2046. (02)713-1585. Meets second Tuesday each month at 8.00 pm in the Burwood RSL.

Lotus 1-2-3 User Group, in Sydney, Ron Pollak, (02)29-5316.

Macarthur Computer Association, J. Napier, 23 Athel Tree Cres., Bradbury 2560. Meets first Monday each month at Airds High School, Briar Road, Campbelltown, at 7.30 pm each month, all machines are catered for. (046)25-2055.

Macquarie Microbee Users Group, Brian Thompson, meetings first Monday each month at Denistone East Primary School at 7.30 pm. (02)85-1659 after hours.

MEGS (Microcomputer Enthus. Group), John Whitlock, P.O. Box 1309, Chatswood 2067. Meetings third Monday each month at rear of St. Andrews Presbyterian Church, 37 Anderson St, Chatswood. (02)638-1142.

Mi Computer Club, Norma Jackson, P.O. Box 21, Waterloo 2017. (02)662-8888.

Newcastle Microbee Users Group, Lee Osman, 12 Cleverton Close, Warners Bay 2282. (049)48-8813.

Newcastle Microcomputer Club, Angus Bliss, P.O. Box 293, Hamilton 2303. Meetings second and fourth Monday each month at room G12, Physics Building, Newcastle Uni. (049)67-2433 ext 326 bh.

NSW Primary School Microbee Users Group, Mr Peter Stretton, c/- Hunters Hill Primary School, ▶

Alexandra St, Hunters Hill 2110.

NSW 6800 Users Group, 27 Georgina Ave, Keiraville 2500.

Northern Beaches VIC User Group, E. Tuxford, 161 Barrenjoey Rd, Newport 2106. (02)997-2467.

Northern NSW MICC Chapter, Alen Hartley, Dundurrabin, via Dorrigo 2433. (066)57-8160.

NSW Peach User Club, Daniel Soussi. Weekly meetings on Saturday from 2 pm at 'Cybernetics Research' 120-122 Lawson St, Redfern. (02)698-8286.

OSI Users Group, Nigel Bisset. (02)411-7142.

Pocket Computer Users Club, George Antonijevic (02)683-54296, for those interested in pocket computers, whatever the brand. Meetings held on the first Wednesday of each month at 7.30 pm at the 'Woodstock' Community Centre, Church St, Burwood.

Sorcerer Users Group, P.O. Box E162, St James 2000. Meetings first Tuesday each month at 7th Floor, Datec House, 220 George St., Sydney at 7.30 pm.

Southern Districts Commodore Users Group, Lex Toms, 602-8691, 3 Lucille Cres., Casula 2170. meetings first and third Wednesday each month, API Hall, Currajong Rd., Prestons.

Sutherland Super 80 Group, Jim Treager. (02)525-2018.

Sydcom 64 (C64 User Group), Andrew Farrell, meetings first Tuesday of each month at 6.30 pm above Computerwave, George St., Sydney. (02)99-2640.

Sydney FORTH Group, Peter Tregeagle, 10 Binda Road, Yowie Bay 2228. (02)524-7490, FORTH Computer Language.

Sydney Microbee Users Club, Colin Tringham, 92-6408, P.O. Box C233, Clarence St, Sydney 2000, Meetings third Sat. each month, 1-5 pm, McMahons Point Hall, Blues Point Rd., North Sydney.

Sydney Peach User Group, Ben Sharif, 261 Northumberland St., Liverpool 2170. (02)601-8493.

Sydney TRS-80 Users Group, meetings second, third and fourth Saturday of each month at Botany. (02)666-4716 bus. hours.

TAG-The Access Group, Bob Dolton, P.O. Box 943, Orange 2800, for Access and Actrix users.

TI Sydney Home Computer U.G., P.O. Box 149, Pennant Hills 2120.

Wagga Microbee Users Group, John Simmons, 47 Undurra Drive, Glenfield 2650. (069)31-1302. Meetings first and third Tuesdays each month in the Tolland-Glenfield Neighbourhood Centre at 8.00 pm.

Wizzard User Group, John Mifsod, 150 Bouganville Road, Blackett 2770. (02)628-0801.

ZX-Spectrum Users Club, Craig Kennedy, P.O. Box 466, Epping 2121.

Victoria

Apple Users Society of Melbourne, D. Halprin, P.O. Box 43, Forest Hill 3131. (03)387-3221.

AT Microcomputer Club, Grant Forest. (03)879-2257 ah, (03)699-2888 bh. This club has been formed for people interested in the Applied Technology DGOS Z80.

Atari User Group Melbourne, Kelvin Eldridge, P.O. Box 173, 3073.

Australian FORTH Interest Group, Tony Latermore, P.O. Box 704, Sale 3850. (051)44-2011.

Australian North Star Users Assoc, P.O. Box 194, Wangaratta 3677.

Ballarat Computer Users Group, Publicity Officer, John Preston. (053)31-4363.

Billanook Computer Forum, Maurie Canterbury, Cardigan Road, Mooroolbark 3138. (03)725-5388.

ABUG 80 (Burwood Users Group), P.O. Box 46, Blackburn South 3130.

CHIP 8, 6800, 1802 User Group, Frank Rees, 27 King St, Boort 3537.

Compucolor Users Group, L. Ferguson, 12 Morphett Avenue, Ascot 3342.

COMX-35 Users Group, Adam Carter, 2 Dougand Circuit, Dingley 3172. Interstate members welcome.

DEC Personal Computer Special Interest Group, see NSW entry.

FORTH Interest Group, Lance Collins, P.O. Box 103, Camberwell 3124. (03)29-2600. Meets on the first Friday of the month.

Geelong Computer Club, Peter McKeon, P.O., Box 93, Geelong 3220.

IBM & Columbia Computer Users Club, Giles Bray, 22/11 Auburn Grove, Hawthorn East 3123. 82-7632, second Tuesday each month, 7.30 pm at the Victorian College of Pharmacy.

Kaypro Users Group of Victoria, George Kunz, P.O. Box 159, Forest Hill 3131. (03)857-5462. Meetings fourth Sunday each month at Burwood State College, Community Resources Centre at 2 pm.

KAOS (Ohio Scientific), David Anear, 49 Millewa Cres., Dallas 3047.

Latrobe Valley Colour Computer U.G., George Francis, 31 Donald St, Morwell 3840. 22-1389, for TRS-80 & MC10 users.

Melbourne Atari Computer Enthusiast, P.O. Box 133, Mulgrave North 3170. Meetings held on first Sunday of each month at 11.40 am at Monash University Rotunda.

Melbourne Lotus 1-2-3 Users Group, Robert Taylor. (03) 267-4800.

Melbourne Microbee Users Group, Pres. Grant Forrest, P.O. Box 157, Nunawading 3131. Meetings 7.00 pm second Wednesday each month at Vic. State College — Burwood Campus, 221 Burwood Highway, Burwood.

Melbourne PC User Group, Stephen Wagen or Christopher Leptos, c/o Pannell Kerr Foster, 14th floor, 500 Bourke St., Melbourne 3000. (03)605-2222 bh.

Melbourne Peach Users Group (MPUG), P.O. Box 191, Rosanna 3084. (03)434-2541.

Melbourne Super 80 Users Group, Sec. Victor Shuttleworth. (03)723-2713.

MICOM, Microcomputer Club of Melb, P.O. Box 60, Canterbury 3126.

Motorola User Group Soc. (MUGS), Clive Allan, 11 Haros Ave., Nunawading 3131. (03)878-1298. Group is interested in 6800/02/09-based computers, particularly if running Flex.

National Mutual Micro Users Group, R. Prewett, NMLA, P.O. Box 2830AA, GPO Melbourne 3001. For National Mutual staff.

National Sinclair User Group, P.O. Box 148, Glen Waverley 3150.

National ZX80 Users Club, 24 Peel St, Collingwood 3066.

NEC Portable Users Group, D. Green, meetings second Wednesday of each month at Myers Computer Centre, Lonsdale St., at 7.30 pm. (03)611-3380.

Northn/Westn Sub. Comp. Users Group, John King (Secretary), 284 Union Road, Moonee Ponds 3039. (03)338-9304. Contact CP/M Data Systems.

Peninsula Computer Club, George Thompson, 3 Patterson St, Bonbeach 3196. 772-2674, second Tuesday each month at Chisholm College, Frankston. Many types of computers are catered for.

Sharp Computer Users Association, The President, 7 Faye St, East Burwood 3151.

Spectravideo Users Group, Mitch Raitt, Fernhill, Tindal's Road, Warrandyte 3113. (03)844-3485.

Sorcerer Computer Users (Australia), Secretary, G.P.O. Box 2402, melbourne 3001.

TI-99/4A Users Group Melbourne, Wayne Worladge, 123 Ashburn Grove, Ashburton. (03)25-1832.

Vic. Assoc. of Computer Educators, Arthur Totrall, P.O. Box 69, Whittlesea 3757.

Victorian VZ200 User Group, Luigi Chiodo, 24 Don St, Reservoir 3073. (03)460-3770.

Victorian Wizzard Users Group, Barry Klein, 24 Russell St, Bulleen 3105.

Yarrawonga Computer User Group, Chris Younger, 10 Witt St, Yarrawonga 3730. (057)44-3859. For all machines.

ZX81 Software Exchange, C/-Chips Taens, 5 Muir St, Mt. Waverley 3149.

QLD.

Apple-Q the Brisbane User Group, The Secretary, P.O. Box 721, South Brisbane 4101. Has User Group days every third Sunday of month at Hooper Education Centre, Kuran St, Wavell Heights. Centre is open from 8.30 am till 4.30 pm. Members encouraged to bring Apple along.

Australian Sirius Users Group, P.O. Box 204, Chermside 4032. (07) 350-2611. Looks after the needs of Sirius One and Victor 9000 computer users. For membership form write to above address.

Basic User Group, Chris Lucey, Cranium Computers, 34 Lawless St, Blackwater 4717.

Brisbane Super 80 Users Group, Gary Gatfield. (08)355-3173.

Brisbane Youth Computer Group, A. Harrison, P.O. Box 396, Sunnybank 4109.

COMPUTER CLUB LIST

Commodore Computer Users Group Qld, Mrs D. D. Dillan, P.O. Box 127, Stones Corner 4120.

Commodore Users Group, John Egan, P.O. Box 274, Springwood 4127. (07)287-2705. For owners of Pet/CBM and VIC-20 machines. Meetings held on the first Tuesday of the month at 130 Petrie Terrace, Brisbane.

Computer Owner's Group, Betty Adcock, 42 Lucan Ave, Aspley 4034. 263-4268. Second Wednesday each month, 7.45 pm, all kinds of computers are catered for.

DEC Personal Computer Special Interest Group, see NSW entry.

Gold Coast Microbee User Group, Col Mclaren, 1-100 Imperial Parade, Labrador 4215. (075) 31-4610. Meetings first Sunday each month, 3.00 pm at the Southport High School.

IREE Microcomputer Interest Group, N. Wilson, P.O. Box 811, Albion 4010.

Mackay Microbee User Group, Geoff Gehring, Box 230, Mackay 4740. (079)42-3214.

Osborne Users Group of Qld Uni, Glen McBridge, meetings second Thursday each month, open to all. (07)371-4243.

Superboard Users Group, Ed Richardson, 146 York St, Nundah 4012.

Tandy, Apple, Commodore UG, Chris Lucey, 34 Lawless St, Blackwater 4717.

The Microcomputer Society, The Secretary, P.O. Box 580, Fortitude Valley 4006. Meetings are held on the second Friday of each month in the Old Town Hall, corner Vulture and Graham Streets, Sth Brisbane. Meetings start at 7.30 pm; if main gate is closed use the back stairway.

Townsville MicroBee User Group TMUG, C/- Town and Country Computers, CTL Centre, Anne St, Aitkenvale 4814. Meetings 7.30 pm on second and fourth Monday each month on the ground floor, St Margaret Mary's Secondary School, Crowle St, Hermit Park.

TRS80/System 80 Interest Group Qld, 396-2998. Meetings on the first Sunday of each month at 21 Rodney St, Lindum, at 2 pm.

ZX 81 Club, P. Carswell, 22 Braud St, Bundaberg 4670.

S.A. & N.T.

AACC, Adelaide Atari Computer Club, meets at Gilles St Primary School, City, on first Monday (second if first is on public holiday) of each month. Secretary, P.O. Box 333, Norwood 5067.

Adelaide Lotus 1-2-3 User Group, Paul Wragg, Pannell Kerr Foster, GPO Box 1969, Adelaide.

Adelaide Micro User Group, R. G. Stevenson, 36 Sturt St, Adelaide 5000. For TRS-80 and System 80 Users.

Adelaide Osborne Group, Russell Barter, The Secretary, 410 Regency Road, Prospect 5082.

Alice Springs Microbee Users Group, Douglas Craigie, c/- P.O. Box 3230, Alice Springs 5750.

Beebnet, BBC and Econet User Group, M. A. Cowley, P.O. Box 262, Kingswood 5062.

CBM/VIC Users Group Of N.T., Ian Diss. (089)27-9208.

Commodore/VIC Computer Users Assoc, Eddie Hann, 13 Miranda Road, Paralowie 5108. The SA branch meets monthly.

Compucolor-Intercolor User of SA, P.O. Box 86, Torrensville 5031. (08)352-3296.

Darwin Microbee Users Group DBUG, Felino Molina, P.O. Box 3111, Darwin 5794. (089)82-5613 bh, (089)88-1455 ah.

DEC Personal Computer Special Interest Group, see NSW entry.

IBM-PC SA Users' Group, P.O. Box 68, Walkerville 5081.

Kaypro User Group, Myles Wakeham, 100 Pirie St, Adelaide 5000. (08)223-6333. meetings first Tuesday each month.

Microbee Users Group of S.A. MUGSA, The Secretary, GPO Box 767, Adelaide 5001.

NT 80 Computer User Group, R. T. O'Brien, 433 McMillans Road, Jingili, Darwin 5792..

SA Commodore Computers UG, Eddie Hann, The Secretary, P.O. Box 427, North Adelaide 5006. 258-6367. Meetings second Tuesday each month, 7.30 at Royal Caledonian Hall, 379 King William St, Adelaide.

SA Hitachi User Group, Cliff Hignett, 45a Ormond Ave, Daw Park 5041. (08)274-9341.

SA Microprocessor Group Inc. SAMG, The Secretary, P.O. Box 113, Plympton 5038. (08)278-7288.

Sorcerer Users Group of SA, Don Ide, 14 Scott Road, Newton 5074.

South Australian Apple Users Club, The Secretary, SAAUC, C/- The Bookshelf, 169 Pirie St, Adelaide 5000.

South East Computer Enthusiasts Group, Glenn Mibus, 3 Millard St, Mount Gambier 5290. (087)25-1046. Meetings second and fourth Tuesday of each month from 6.30 pm at Mt Gambier High School Computer Room, for all machines and interested parties.

The Microcomputer Assoc. of the NT, Andy Smith, Darwin Community College, Casuarina 5792.

VZ200 Users Club, 7 Abbott Cres, Malak, Darwin 5793. (089) 27-2830.

W.A.

Agriculture Users Group, C/- Mr R. Fenwick, Dept. of Agriculture, Albany 6330. For farmers and the agriculture service industries.

CU West WA Compucolor/ Intercolor U.G, John Newman, 8 Hillcrest Drive, Darlington 6070.

DEC Personal Computer Special Interest Group, see NSW entry.

KAOS-W.A., Gerry Ligtermoet, (09)450-5081, 39 Cloister Ave., Manning 6152. For Ohio Scientific Users.

OSWEST-Osborne UsersGroup of WA, (09)330-3439.

Kaypro User Group of WA, Ainslie Sharpe, P.O. Box 91, Claremont 6010. (09)384-5511. meetings second and fourth Mondays of each month in the canteen of the Department of Agriculture, Jarrah Road, South Perth.

Perth 80 Users Group, C. Powell. (09)457-6849. For system 80 and TRS 80 Users.

Perth Hitachi Peach Club, The Secretary, 1 Charf Court, Riverton 6155. (09)367-5880. For Hitachi Peach and 6809s.

Sorcerer Computer Users of Aust, The Secretary, 90 King George St, Perth South 6151. (09)367-6351.

Super 80 Users Group Perth, Garry Black, 19 Bendigo Way, City Beach 6015. (09)385-8813.

The WA Atari Computer Club, Alf Gaebier (Secretary). P.O. Box 7169, Cloisters Square, Perth 6000.

WA Microbee Club, Mike Osborn. (09)447-5366.

VIC-Ups, G. Padfield. (09)451-4629.

WA Wizzard Users Group, John Reid, 13 Wenlock Road, Wattleup 6166. (09)410-2359.

WA ZX Users Group, Phil Taylor. (09)328-4111 bh.

WA University Computer Club, Second Floor, University of WA, Guild Building. (09)386-1455.

Tasmania

DEC Personal Computer Special Interest Group, see NSW entry.

Devonport Computer Interest Group, John Steveson, R.S.D. 422, Sheffield Tasmania 7306. (004)92-3237.

Spectravideo Computer Users Group, W. P. Decket, 48 Heather St, Launceston 7250. 44-4836, Membership to the club costs $15 which entitles members to a newsletter and to discounts on computer equipment.

TASBEEB, John Hannon, P.O. Box 25, North Hobart 7000. Meetings first Monday each month at Elizabethan Matriculation College in D Block at 8 pm. (002)34-2704. For BBC computers.

Tasmanian TI User Group, Co-ordinator, 1 Benboyd Court, Rokeby 7019. (002)29-4009. Meetings third Sunday of each month at University of Tasmania, room 373.

TAS-Micro, Peter Deckert, Unit 1/456 West Tamar Road, Riverside, Launceston 7250.

Tasmanian Commodore Users Assoc, Vincent T. Staggard, The Secretary, G.P.O. Box 391D, Hobart 7000. (002)72-0295. Commodore and others.

Tasmanian OSI User Group, David Tasker, 111 Bass Highway, Westbury 7303.

N.Z.

1802 Users Group, P.O. Box 6210, Auckland, New Zealand. For those who own an ETI-660 or a COSMAC VIP, you can contact the 1802 Users Group. Be kind and send them a return addressed envelope and some International Reply Coupons.

Nelson Vic Users Group, Peter Archer, Nelson VIC Users Group, C/- P.O. Box 860, Nelson NZ, for VIC and Commodore.

Wellington Microcomputer Soc. Inc., Lindsay Williams, 2 Pope St, Pimmerton, New Zealand.

ZX81 Club, R. Skelton, C/- Harbourside Orchard. Waiuku, New Zealand.

LUCKY LOTTO

The object of the 'Lucky Lotto' program for the VIC-20 is to select six random numbers and to display them in the form of a coupon. Line 10 gives the screen a yellow background, while lines 15-20 do the number selection and make sure that no number is repeated. Lines 100-170 print a coupon with red figures, and then lines 200-395 turn the selected numbers black.

D. J. Donoghue, Inhala Qld

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1 OPEN 3,4
2 CMD 3
3 PRINT"GOLD LOTTO"
4 LIST
5 REM LUCKY LOTTO BY
10 POKE36879,122
15 FORN=1TO6
20 Q(N)=INT(RND(1)*40)+1
25 NEXT
30 FORY=1TO5
35 FORZ=1TO5
40 IFQ(Z)>Q(Z+1)THENA=Q(Z):
   Q(Z)=Q(Z+1):Q(Z+1)=A
45 NEXT
50 NEXT
55 FORS=1TO5
60 IFQ(S)=Q(S+1)THENQ(S)=INT(RND(1)*40)+1:GOTO30
65 NEXT
100 PRINT"□"
110 PRINT"■      GOLD LOTTO  "
120 PRINT"■■■ 1  2  3  4  5  6  7"
130 PRINT"■ 8  9 10 11 12 13 14"
140 PRINT"■15 16 17 18 19 20 21"
150 PRINT"■22 23 24 25 26 27 28"
160 PRINT"■29 30 31 32 33 34 35"
170 PRINT"■36 37 38 39 40"
200 IFQ(1)=1ORQ(2)=1ORQ(3)=1ORQ(4)=1ORQ(5)=1ORQ(6)=1THENPOKE38488+1,0
205 IFQ(1)=2ORQ(2)=2ORQ(3)=2ORQ(4)=2ORQ(5)=2ORQ(6)=2THENPOKE38488+4,0
210 IFQ(1)=3ORQ(2)=3ORQ(3)=3ORQ(4)=3ORQ(5)=3ORQ(6)=3THENPOKE38488+7,0
215 IFQ(1)=4ORQ(2)=4ORQ(3)=4ORQ(4)=4ORQ(5)=4ORQ(6)=4THENPOKE38488+10,0
220 IFQ(1)=5ORQ(2)=5ORQ(3)=5ORQ(4)=5ORQ(5)=5ORQ(6)=5THENPOKE38488+13,0
225 IFQ(1)=6ORQ(2)=6ORQ(3)=6ORQ(4)=6ORQ(5)=6ORQ(6)=6THENPOKE38488+16,0
230 IFQ(1)=7ORQ(2)=7ORQ(3)=7ORQ(4)=7ORQ(5)=7ORQ(6)=7THENPOKE38488+19,0
235 IFQ(1)=8ORQ(2)=8ORQ(3)=8ORQ(4)=8ORQ(5)=8ORQ(6)=8THENPOKE38532+1,0
240 IFQ(1)=9ORQ(2)=9ORQ(3)=9ORQ(4)=9ORQ(5)=9ORQ(6)=9THENPOKE38532+4,0
245 IFQ(1)=10ORQ(2)=10ORQ(3)=10ORQ(4)=10ORQ(5)=10ORQ(6)=10THENPOKE38538,0:POKE38
539,0
250 IFQ(1)=11ORQ(2)=11ORQ(3)=11ORQ(4)=11ORQ(5)=11ORQ(6)=11THENPOKE38541,0:POKE38
542,0
255 IFQ(1)=12ORQ(2)=12ORQ(3)=12ORQ(4)=12ORQ(5)=12ORQ(6)=12THENPOKE38544,0:POKE38
545,0
260 IFQ(1)=13ORQ(2)=13ORQ(3)=13ORQ(4)=13ORQ(5)=13ORQ(6)=13THENPOKE38547,0:POKE38
548,0
265 IFQ(1)=14ORQ(2)=14ORQ(3)=14ORQ(4)=14ORQ(5)=14ORQ(6)=14THENPOKE38550,0:POKE38
551,0
270 IFQ(1)=15ORQ(2)=15ORQ(3)=15ORQ(4)=15ORQ(5)=15ORQ(6)=15THENPOKE38576,0:POKE38
576+1,0
275 IFQ(1)=16ORQ(2)=16ORQ(3)=16ORQ(4)=16ORQ(5)=16ORQ(6)=16THENPOKE38579,0:POKE38
580,0
280 IFQ(1)=17ORQ(2)=17ORQ(3)=17ORQ(4)=17ORQ(5)=17ORQ(6)=17THENPOKE38582,0:POKE38
583,0
285 IFQ(1)=18ORQ(2)=18ORQ(3)=18ORQ(4)=18ORQ(5)=18ORQ(6)=18THENPOKE38585,0:POKE38
586,0
290 IFQ(1)=19ORQ(2)=19ORQ(3)=19ORQ(4)=19ORQ(5)=19ORQ(6)=19THENPOKE38588,0:POKE38
589,0
295 IFQ(1)=20ORQ(2)=20ORQ(3)=20ORQ(4)=20ORQ(5)=20ORQ(6)=20THENPOKE38591,0:POKE38
592,0
300 IFQ(1)=21ORQ(2)=21ORQ(3)=21ORQ(4)=21ORQ(5)=21ORQ(6)=21THENPOKE38594,0:POKE38
595,0
305 IFQ(1)=22ORQ(2)=22ORQ(3)=22ORQ(4)=22ORQ(5)=22ORQ(6)=22THENPOKE38620,0:POKE38
620+1,0
310 IFQ(1)=23ORQ(2)=23ORQ(3)=23ORQ(4)=23ORQ(5)=23ORQ(6)=23THENPOKE38623,0:POKE38
624,0
315 IFQ(1)=24ORQ(2)=24ORQ(3)=24ORQ(4)=24ORQ(5)=24ORQ(6)=24THENPOKE38626,0:POKE38
627,0
320 IFQ(1)=25ORQ(2)=25ORQ(3)=25ORQ(4)=25ORQ(5)=25ORQ(6)=25THENPOKE38629,0:POKE38
630,0
325 IFQ(1)=26ORQ(2)=26ORQ(3)=26ORQ(4)=26ORQ(5)=26ORQ(6)=26THENPOKE38632,0:POKE38
633,0
330 IFQ(1)=27ORQ(2)=27ORQ(3)=27ORQ(4)=27ORQ(5)=27ORQ(6)=27THENPOKE38635,0:POKE38
636,0
335 IFQ(1)=28ORQ(2)=28ORQ(3)=28ORQ(4)=28ORQ(5)=28ORQ(6)=28THENPOKE38638,0:POKE38
639,0
340 IFQ(1)=29ORQ(2)=29ORQ(3)=29ORQ(4)=29ORQ(5)=29ORQ(6)=29THENPOKE38664,0:POKE38
664+1,0
345 IFQ(1)=30ORQ(2)=30ORQ(3)=30ORQ(4)=30ORQ(5)=30ORQ(6)=30THENPOKE38667,0:POKE38
668,0
350 IFQ(1)=31ORQ(2)=31ORQ(3)=31ORQ(4)=31ORQ(5)=31ORQ(6)=31THENPOKE38670,0:POKE38
671,0
355 IFQ(1)=32ORQ(2)=32ORQ(3)=32ORQ(4)=32ORQ(5)=32ORQ(6)=32THENPOKE38673,0:POKE38
674,0
360 IFQ(1)=33ORQ(2)=33ORQ(3)=33ORQ(4)=33ORQ(5)=33ORQ(6)=33THENPOKE38676,0:POKE38
677,0
365 IFQ(1)=34ORQ(2)=34ORQ(3)=34ORQ(4)=34ORQ(5)=34ORQ(6)=34THENPOKE38679,0:POKE38
680,0
370 IFQ(1)=35ORQ(2)=35ORQ(3)=35ORQ(4)=35ORQ(5)=35ORQ(6)=35THENPOKE38682,0:POKE38
683,0
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375 IFQ(1)=36ORQ(2)=36ORQ(3)=36ORQ(4)=36ORQ(5)=36ORQ(6)=36THENPOKE38708,0:POKE38
708+1,0
380 IFQ(1)=37ORQ(2)=37ORQ(3)=37ORQ(4)=37ORQ(5)=37ORQ(6)=37THENPOKE38711,0:POKE38
712,0
385 IFQ(1)=38ORQ(2)=38ORQ(3)=38ORQ(4)=38ORQ(5)=38ORQ(6)=38THENPOKE38714,0:POKE38
715,0
390 IFQ(1)=39ORQ(2)=39ORQ(3)=39ORQ(4)=39ORQ(5)=39ORQ(6)=39THENPOKE38717,0:POKE38
718,0
395 IFQ(1)=40ORQ(2)=40ORQ(3)=40ORQ(4)=40ORQ(5)=40ORQ(6)=40THENPOKE38720,0:POKE38
721,0
400 PRINT"■■  TO GET NEXT CARD"
410 PRINT"■■     HIT ANY KEY"
420 GETA$:IFA$=""THEN420
430 RUN

READY.
```

INVADER MATH

Ric Kube, Waikerie, SA

This game will work with the unexpanded VIC or with the 3K expansion board.

```
 10 REM INVADER MATH
 20 FORN=7384TO7384+15:READA:POKEN,A:NEXT:FORN=7424TO7431:POKEN,0:NEXT
 30 DATA36,126,219,219,219,126,36,195
 40 DATA146,84,56,254,56,84,146,0
 50 POKE36869,255:PRINT"■"TAB(5)"■■INVADER MATH":POKE36879,8
 60 FORA=0TO10:POKE36878,13:FORB=255TO128STEP-19:POKE36877,B:POKE36875,B
 70 POKE7680+A*23,27:POKE7701+A*21,27:POKE38400+A*23,3
 80 POKE38421+A*21,3:FORP=1TO200:NEXT:NEXT:POKE7680+A*23,32:POKE7701+A*21,32:POKE
 36878,0:NEXT
 90 POKE7910,27:POKE38400+22*11+10,3:POKE36877,0:POKE36875,0
100 PRINT"■■■TO SHOOT THE INVADER  YOU NEED TO TYPE THE  ANSWER TO THE"
110 PRINT"■■PROBLEM. IF YOU SUCCEED, ANOTHER WILL APPEAR SOMEWHERE ELSE FOR YOUTO
 SHOOT"
115 PRINT"■■DO YOU WANT TO ADD OR MULTIPLY"
116 GETA$:IFA$=""THEN116
117 IFA$="A"THENZZ=1:GOTO120
118 IFA$="M"THENZZ=2:GOTO120
119 GOTO116
120 PRINT"■PRESS ANY KEY"
130 GETA$:IFA$=""THEN130
140 PRINT"■"TAB(5)"■■INVADER MATH"
170 FORA=10TO0STEP-1:POKE36878,15:FORB=255TO128STEP-19:POKE36877,B:POKE36875,B
180 POKE7680+A*23,27:POKE7701+A*21,27:POKE38400+A*23,3
190 POKE38421+A*21,3:FORP=1TO200:NEXT:NEXT:POKE7680+A*23,32:POKE7701+A*21,32:POK
E36878,0:NEXT
200 POKE7910,27:POKE38400+22*11+10,3:POKE36877,0:POKE36875,0
210 PRINT"■■■■■■■■INVADER MATH"
220 S=72:D=0:FORY=1TO9:POKE7746+22*Y,186-Y:POKE7966+2*Y,Y+176:NEXT
230 Q=(INT(RND(1)*9)*2)+2:FORR=INT(RND(1)*7)+1TO8
240 LA=7768+Q+R*22:POKE36878,15:CO=30720
250 FORL=7768+QTOLASTEP22
260 POKEL,27:POKECO+L,3:POKE36877,200:POKE36875,155:FORPA=1TO15
270 NEXT:POKE36877,0:POKE36875,0:POKEL,32:NEXT
280 POKE7768+Q+R*22,27:POKECO+7768+Q+R*22,3:POKE36876,0
290 PRINTTAB(4)"■■■■■■■■■■■■■■■■■■■■■■SCORE"D
300 PRINTTAB(4)"■■■■■■■■■■■■■■■■■■■■■■HIGH SCORE"HI
310 ANS=0
320 PRINT"■■■■■■■■■■■■■■■■■■■■YOUR ANSWER IS ";:INPUTANS
330 PRINT"■■■■■■■■■■■■■■■■■■■■                "
340 IFZZ=1ANDANS=(Q/2)*(9-R)THEN480
350 IFZZ=2ANDANS=(Q/2)*(9-R)THEN480
360 S=S-R:IFS<=0THEN400
370 POKE7768+Q+R*22,32
380 IFR=8THEN510
390 R=R+1:POKE36877,200:POKE36875,155:FORPA=1TO15:NEXT:POKE36877,0:POKE36875,0:G
OTO230
400 PRINT"■■■■■■■■■■■■■■■■■■■■GAME OVER          "
410 IFD>HITHENHI=D
420 PRINT"■■■■HIGH SCORE:"HI
430 FORN=1TO5000:NEXT
440 POKE198,0:PRINT"■■ANOTHER GAME?"
450 GETA$:IFA$=""THEN450
460 IFA$<>"Y"THENPOKE36869,240:POKE36879,27:PRINT"■■":END
470 GOTO210
480 POKE7768+Q+R*22,28:POKECO+7768+Q+R*22,2
490 POKE36877,255:FORL=15TO0STEP-2:POKE36878,L:FORM=1TO250:NEXTM,L:POKE36877,0:P
OKE36878,0
500 D=D+1
510 FORN=1TO500:NEXT
520 POKE7768+Q+R*22,32:GOTO230

READY.
```

803 Left Little

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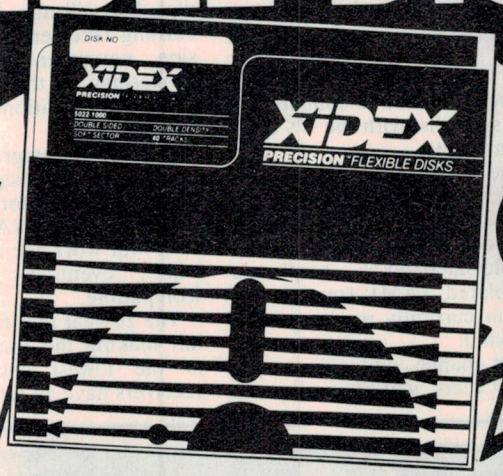

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803 Right Little

Single sideband slated for shortwave broadcasters

A recent decision at the World Administrative Radio Conference in Geneva will ensure that shortwave broadcasters will gradually move to single sideband (SSB) transmission over the next two decades.

It's a warning given in ample time so that radio listeners purchasing a new receiver can make certain it is capable of SSB reception.

Millions of listeners throughout the world will have to buy new receivers, or else the voices they hear now will turn to gibberish.

"It's going to be a lot like listening to Donald Duck" (the popular cartoon character) says Walter Ireland, a communication specialist with the US State Department.

The International Telecommunications Union (ITU), a United Nations agency, recommended the conversion from the double-sideband amplitude modulated (AM) transmission system currently used to single sideband.

The change, under discussion for 10 years, will open up more space on the crowded shortwave dial, but will also render many existing receivers and transmission equipment obsolete, a spokesman for the International Telecommunications Union in Geneva said.

It will be done gradually over 20 years, so receivers and transmitters designed for the current double-sideband (AM) broadcasts will work for a while, but will eventually become icompatible.

The 20-year duration will permit making the transformation at the lowest cost. Existing receivers have an estimated lifespan of about 10 years, while transmitters are good for about 15.

Although no one knows exactly how many people listen to shortwave, it is estimated that at least 100 million listeners will be affected throughout the world.

The decision to make the changeover was agreed upon at the World Administrative Radio Conference in Geneva earlier this year where 575 delegates from 115 countries attended. A date for starting the changeover is to be set at a follow-up conference in 1986.

World-wide talkback! Douglas Muggeridge, BBC's External Broadcasting Manager, prepares for a world phone-in last December with Margaret Howard.

BBC expands audience

One problem faced by international broadcasters is the difficulty of obtaining an accurate audience figure. Only in North America has the popularity of shortwave stations been recently surveyed.

Incoming mail is the main guideline by which stations estimate their audience. A report that the BBC External Service mail has shown a sharp increase has led to revised figures of their world-wide audience, formerly estimated at around 100 million listeners.

The mail pouring into Bush House, London, home of the BBC World Service, last year was 450,000 letters — an increase of 33 per cent on the previous year!

Writing to the BBC from the Third World is an expensive undertaking due to the high postage cost and the meager family income. In the Eastern European countries there is always a threat of political reprisal if one writes to a broadcasting station in the West.

The BBC, along with several other international broadcasters, has set up post boxes at embassies, such as Delhi, where listeners can write to the BBC at the cost of only internal postage, as the letters are sent on in bulk from Delhi to London.

In a recent statement, the BBC Managing Director, Douglas Muggeridge, said that there is certainly evidence of growing numbers of young people listening to the BBC programmes.

Mr Muggeridge concluded, "It is encouraging that more listeners than ever before are sufficiently stimulated by the BBC to send us letters, in many cases at considerable personal cost, either in political or financial terms".

The extra letters came from countries spread across the world, but the bulk of the new mail came from Africa.

The BBC World Service has recently made some frequency adjustments to its service to Australia up to September 29.

The major frequencies remain the same with the service 0600-0915 hours UTC on 9510, 9640, 11955, and 15070 kHz. From 0900-1130 hours, 11750 and 21550 kHz carries the broadcast and after this time 9740 and 15310 kHz are the main frequencies.

Morning reception in Australia is available from London, and from 2000 hours UTC 9410, 9570 and 15070 kHz are the primary frequencies. During the early afternoons, at 0300 hours UTC, listeners in Australia should find 15380 kHz providing fair reception.

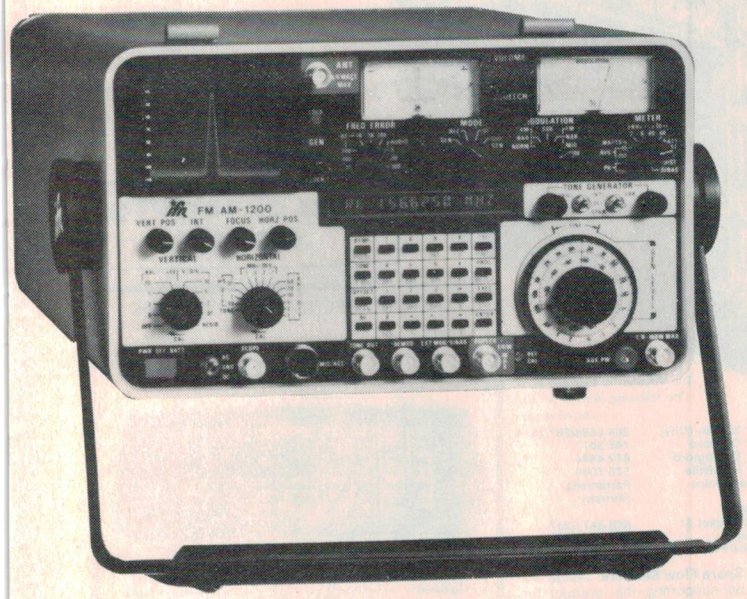
Go west

Kensor, of Western Australia, has commenced manufacturing communication equipment for the Australian market.

Kensor is an amalgam of Australian and overseas interests, designed to bring the latest overseas technology to Australia and also export Australian-made products worldwide.

Locally developed products includes VHF radio telemetry equipment and MF non directional beacons. They are also representing Sinclair Radio Laboratories of Canada and Antenna Engineering of Singapore.

For more information contact **Kensor, 12 Hehir St, Belmont WA 6104. (09)478-2333.**



Test gear

Vicom recently announced the release of a new multi-function communications service monitor produced by IFR of the USA.

Fully portable, the FM1200 covers the range 250 KHz to 1 GHz and features an RS232 interface buss and generator/receiver scan, RF memory, tone memory and programmable display intensity.

With a processor-based system like this, it is possible to display analog test responses digitally. The internal non-volatile memories allow the monitoring and automatic testing capabilities to display the vacuum fluorescent display frequency, frequency error to one hertz resolution, modulation both AM and FM, RF power, SINAD, distortion, signal strength duplex offset and a variety of pulse, tone and tone sequence formats.

A special feature of the FM1200 is its ability to simultaneously generate a fixed output level and simultaneously receive a signal. This duplex testing facility allows testing of repeaters and their associated systems both in 'off air' or separate transmit receive lines.

The unit also contains a signal generator and spectrum analyser.

Further details are available from **Vicom Australia, 57 City Road, South Melbourne Vic. (03)62-6931.**

Receiver shopping guide

One of the main questions asked by the newcomer to shortwave listening is what sort of equipment is available and its range and price. Radio Nederland has issued its seventh edition of its 'Receiver Shopping Guide' and in its 24 pages, it gives details of the main receivers which are available world wide. The sixth edition was published in March, 1983 and was an extensive inventory of receivers with details on their coverage, price, weight etc. and the name of the agent in several countries. Since that edition another 18 shortwave receivers have been added to the world market, and these have moved increasingly to channel selection, push button system, rather than the conventional knobs and read-out dial. Copies of the 'Receiver Shopping Guide' are available free on request from Media network, Radio Nederland, P.O. Box 222, Hilversum, Holland JG 1200.

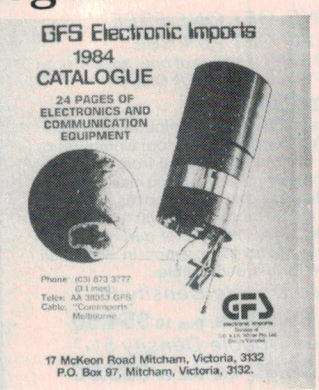
Radio Nederland has also produced several other brochures to assist the shortwave listener, and one of these, 'The Booklist', which is now in its 6th edition has a comprehensive coverage of publications, such as books, periodicals and annuals which are of value to the radio listening hobbyist. A pamphlet on aerials both for indoor and outdoor use is also available from Radio Nederland.

1984 GFS catalogue

GFS Electronic Imports now has available its 1984 colour catalogue, continuing 24 pages of communications and electronic equipment.

Fully illustrated and containing complete specifications on all their products this catalogue makes a useful reference for those with any interest in the area of communications.

If you would like a copy contact **GFS Electronic Imports, 17 McKeon Road, Mitcham Vic 3132. (03)873-3777.** Please include $0.75 for postage.



KILOHERTZ COMMENT

ALASKA: KNLS has made some frequency changes for our winter reception period. This schedule is valid up to September 1 and the broadcast from Anchor Point, Alaska, to the Pacific between 0700 and 0930UTC is on 11 940 kHz. From September 1 this changes to 6100 kHz.

Other broadcasts are in Russian 0930-1200 hours, Chinese 1200-1430 hours, both on 11 940 kHz and changing to 6100 kHz on September 2; Russian to Europe 1500-1730 hours on 11 790 kHz to September 1, then 6085 kHz to September 29, and 6095 kHz to November 3. English from 1730-2000 hours continues on these same frequencies.

FRANCE: Radio France International has English transmission from 0415- 0430 hours and 0445-0500 hours on 7135, 9790 and 11 875 kHz, and again at 1600-1700 hours on 15 315 and 17 795 kHz.

The relay from Montsinery, French Guyana is now in operation from three, 500 kW transmitters. It broadcasts from 2200-0200 hours at present and can be received on 15 185 and 15 435 kHz. It is expected that the transmission will be extended with an English news programme from 0330-0400 hours.

NEW ZEALAND: The Radio New Zealand Shortwave Service has moved from 17 705 to 17 710 kHz from 2115-0315 hours, then 11 960 kHz is used between 0330 and 1215 hours.

Other transmissions are from 1800-2100 hours on 11 960 and 15 485 kHz; 2115-0515 hours 15 485 kHz; 0530-1215 hours on 9520 kHz. Both 9520 and 15 485 kHz transmissions are beamed to Australia and Papua New Guinea.

SWEDEN: Radio Sweden International, Stockholm, has English broadcasts from 1100-1130 hours to Australia but the proposed frequency of 15 120 kHz has suffered interference and a complaint from Deutsche Welle has requested a new frequency. Following a telex from Stockholm, the writer has suggested 15 115 kHz.

SWITZERLAND: Berne has changed its frequency for English programming at 0430-0500 hours, replacing 11 715 kHz by 12 035 kHz. The other frequency, 9720 kHz, carries the programme for this English broadcast, which features "Shortwave Listeners Merry-go-round" on the second and fourth Sunday of each month.

TURKEY: Ankara is using 11 755 and 17 815 kHz from 0300 to 0350 hours in English with the first frequency beamed to North America and the second to South East Asia.

YUGOSLAVIA: A difficult signal to receive is Radio Yugoslavia, broadcasting from Belgrade, on 6100 kHz. Its giving best reception with English around 1900-1930 hours. The other frequencies carrying the programme are 7240 and 9620 kHz.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All items quoted are UTC (GMT) 10 hours behind Sydney time. All frequencies are in kilohertz (kHz).

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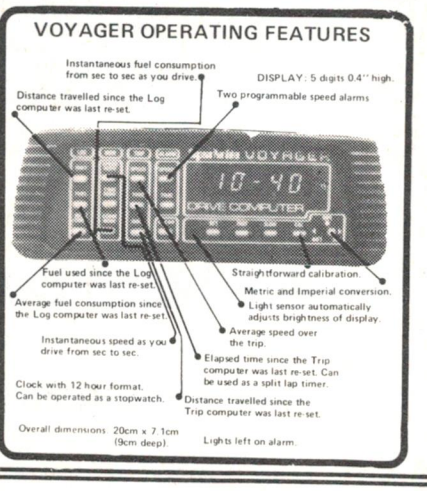

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How the BBC and CIA Keep Tabs on the World

Arthur Cushen, MBE
212 Earn St, Invercargill, New Zealand

If you want to *really* know what's going on in the world — listen to what it's saying! This is how the BBC's superlative news service is kept abreast of world affairs and how America's Central Intelligence Agency keeps Washington and the President informed.

LISTENING to news bulletins in some 40 languages is a major role of the BBC monitoring service. By eavesdropping on local broadcasting, the main news stories of the day are often first revealed.

Particularly today, with political unrest, rapid changes of government and the unstable situation in many countries, radio is the first means of learning of events as they happen.

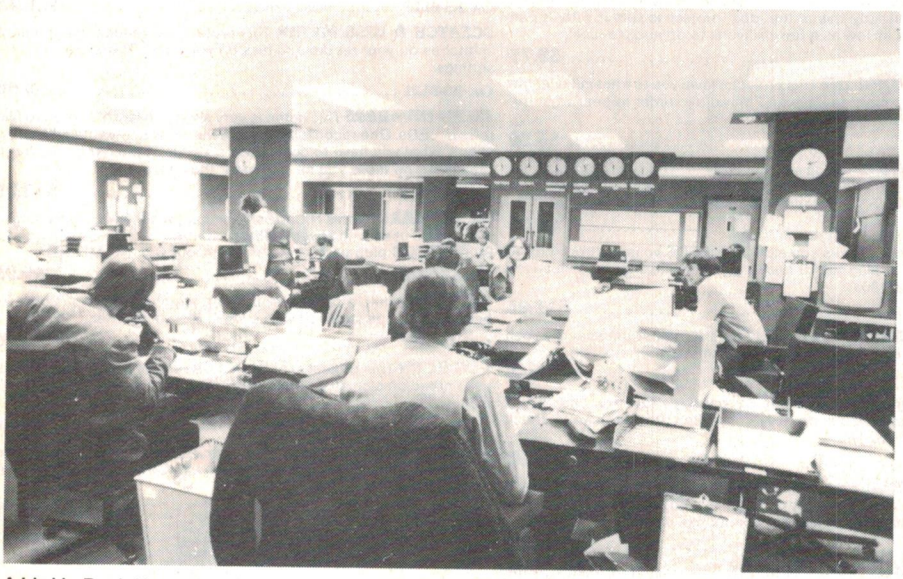
Local broadcasting, via radio, is not confined to the population within a country. There is little possibility of using radio as a means of releasing information to the local people without it being heard by keen news monitors somewhere in the world.

I have had many occasions when I've been able to supply Radio New Zealand, or the private commercial networks, actual recordings of announcements, giving the first news of a sensational government move or the death of a world figure.

It is a matter of knowing when and where to listen that gives the keen shortwave listener an advantage and if one is news conscious, then the chances of being at the right spot on the radio dial when a news story breaks is a distinct possibility.

BBC monitoring service

The continued expansion of world broadcasting has a more immediate impact on the monitoring service, than on any other part of the BBC as it represents a direct increase in the task of listening and reporting. The job of the BBC monitoring service is to provide speedy and accurate reports of significant news and comment from foreign broadcasting stations in all parts of the world.



A bird in Bush House is worth . . . Much of the news gathered by the BBC Monitoring Service is fed to the newsroom in Bush House. This photo shows the newsroom where more than 250 news programmes are prepared every day for broadcast on the BBC's External Services. They are compiled in a newsroom which, with an editorial staff of well over a hundred, is the biggest in the BBC and one of the largest in the world.

It is a national service, supplying information not only to the BBC itself, but also to government departments, the press, and other bodies concerned with international affairs. It works in close collaboration with its United States counterpart under an exchange agreement, which means virtually world-wide coverage. In return for its own extensive product, the monitoring service is able to receive and supply to its customers material from stations principally in the Far East and Latin America which are received by United States monitors.

The service is based at Caversham, near Reading, and has two main parts — Reception, which is responsible for listening, and Transcription and Output which selects and edits material for sending out by teleprinter and printed documents to numerous recipients. There is also a small unit in Nairobi with the primary task of monitoring broadcasts directed to or emanating from East and Central Africa.

Technical facilities are provided by the BBC Engineering Division, and include a separate receiving station at Crowsley Park in Oxfordshire.

In the reception unit, voice broadcasts are listened to live, to ensure the speediest reporting of important news, and recorded so that the monitor playing back the recording can secure the greatest accuracy in translation. A high degree of linguistic and translating ability is naturally required from the individual monitor. Subject to general directives, the monitor is expected to exercise judgements in the primary selection of material.

Receivers

The BBC monitoring service is world-renowned for its use of news bulletins from foreign stations.

These are incorporated in BBC news or the World Information Bulletin released each week and based on listening by the monitoring service.

The equipment used is of the highest quality and, having visited the monitoring ▶

Listen to the world! A section of the listening room at the BBC Monitoring Service at Caversham Park.

service, I can vouch for the high standard of equipment and the aerial systems.

According to Chris Greenway, the manager of the monitoring station, the best receiver is the Racal 1772. The monitoring service's standard receiver is the Racal 1792 which costs about A$10 000 on the open market. It is fully synthesised, has 99 memories and is very stable in operation.

The BBC also has examples of the 30-year-old GEC BRT 400 and the Racal RA17 from the late fifties. Chris Greenway rated the Racal a very nice piece of DX gear when he was interviewed for the Austrian Radio Panorama programme recently.

There is a choice of five aerial types for connection to each monitor's receiver — an 80 m beveridge, 77 sloping V, 60 rhombic, 60 beveridge and a 57 rhombic. Beveridge aerials are positioned at 20 degree intervals around the compass. DXing of unknown transmissions is achieved quickly via the post office which takes a bearing and telexes its opposite number in an appropriate country, asking it to do likewise; the bearings are phoned back to the BBC, so that the location can be identified.

CIA monitoring service

In the United States a similar organisation to the BBC monitoring service exists, though its listening information is not available to the general public. In a recent *New York Times* report, comment was made that the first indications that something important is stirring in foreign capitals are often the whispers, rumours and fragmentary dispatches of friend and foe alike reported by radio and television broadcasts around the world.

Twenty four hours a day, broadcasts are monitored by a little known arm of the Central Intelligence Agency, the Foreign Broadcast Information Service (FBIS). When rumours foreshadowing a major announcement in Moscow began to circulate, analysis at the intelligence agency tuned into the FBIS. What they heard was confusion.

The FBIS sifts items for news at its central office in Rosslyn, Virginia. Agents in the field glean news daily from foreign radio and television broadcasts and from newspapers. The material is compiled for eight daily reports on the world's regions which are published each weekday. Foreign broadcasts sometimes reach Washington before word can be relayed by the CIA's more active gatherers of information.

In the case of the recent death of Soviet leader, Yuri Andropov, agency officials said in response to questions from the press that they had heard nothing of unusual activity in Moscow. Those monitors who follow Radio Moscow closely found that there was a sudden switch of programme material and the playing of classical music in place of their regular programming as they did when Leonid Breshnev, the previous Soviet leader, died in 1982.

This example is typical of a major news story monitored by the various listening services. Monitoring enables the radio services to often be aware hours before the official announcement of major world events.

Listening equipment

Readers may be interested in the equipment used by the writer in his work as a technical representative for many international stations.

The monitoring of BBC signals is confined to a domestic type receiver. The Sony ICF2001, which is widely use throughout the world, is the basis on which BBC reception is graded in New Zealand. BBC engineers like to receive reports in a domestic situation so that the reception is typical of that experienced by any listener.

Since first commencing to monitor the BBC in 1942 an Ekco 7-tube receiver was used, which was later replaced by an Eddystone 840A. Since 1980 three Sony ICF 2001 receivers have been used for all monitoring work. This covers not only the BBC, but Radio Canada International, Voice of America and Radio Sweden reported on a weekly basis. Vatican Radio, Radio Netherland and the Italian Radio are reported monthly.

The aerial consists of a conventional inverted-L, 10 metres high and 30 metres long. In all, six aerials are fed into a push-button system from a 20 metre lattice tower in my property. These include a trapped, multi-band dipole and several long wire aerials running across neighbours' properties to a mast further down the street.

For DX listening I have the choice of a Racal RA17, Hallicrafters SX122, McKay Dymek DR22, Allied SX190 and several other receivers. As I am blind, all incoming signals are recorded and from this information the reception report to the distant radio station is prepared. The final typed copy is produced by one of the office staff.

As well as aerials, an earth is essential. Mine is in the form of a large concrete pipe set in the ground, filled with rocks, surrounding a copper pipe. It is kept in a damp condition, providing a good earth to all receivers.

The recording equipment includes two Telefunken reel-to-reel recorders, as well as several tape decks including JVC and AIWA models. A phone line is fed into the recorders so that news bulletins and information of value to local and national radio services can be fed to stations in Invercargill or as far afield as Auckland.

The monitoring of signals both in war time and peace has given me a unique place in radio history providing many news stories hours ahead of conventional information received by radio services or the press. ●

Last year the USA proposed the use of satellites as platforms for shortwave sound broadcasting transmitters. These could relieve the congestion and interference now experienced by ground-based international shortwave broadcasters. This article outlines the requirements and possible performance of such a system.

SATELLITES AND SHORTWAVE

John Kennewell
Learmonth Solar Observatory, Ionospheric Prediction Service

EVEN A CASUAL shortwave listener soon comes to realise that all is not well with sound broadcasting in the high frequency bands between 3-30 MHz. Tuning across the dial from 60 to 13 metres reveals many frequency channels that are occupied by more than one transmitter. The result is frequently an unintelligible cacophony of sound which destroys the utility of the channels for all. Although most of the transmissions attempt to convey meaning through modulation in one of the world's many languages, there is the occasional emission which deliberately aims to destroy the intelligibility of signals upon which it is imposed.

There are around 150 nations in the world today. Many of these have shortwave transmitting facilities. The high frequency band, through ionospheric reflections, offers an economical and accessible way of conveying to the rest of the world a country's unique philosophy on life. Whether it be an espousal of politics or religion, an attempt to teach a language or simple medical facts, ethnic entertainment, or merely a desire to present a view of world news compatible with one's ideology, HF broadcasting, given the right conditions, is an ideal medium for use by even the smallest nations. Unfortunately, conditions are not always ideal.

The ionosphere, upon which all long distance terrestrial transmissions depend, is a function of many variables. Its reflective properties depend on geographical position, time of day, season, transmission frequency, and the periodic and capricious nature of its sustainer, the Sun. To cope with all these variables, many national administrations operate multiple services, with several transmitters spread not only over adjacent bands, but also within the one band. Only in this manner can they be relatively assured of reasonable coverage of their desired target areas.

Unfortunately, there are simply just not enough HF broadcasting channels to accommodate this practice without significant mutual interference. This is particularly true during the years of low solar output; a time when the maximum useable frequencies (MUFs) on all transmissions paths are reduced.

To overcome some of these problems, what may be regarded as a rather radical area has recently been reconsidered. In a draft report to the CCIR (International Radio Consultative Committee) the USA last year proposed the use of satellites as platforms for shortwave sound broadcasting transmitters.

The idea is not entirely new, as feasibility studies of this concept were made in the early 1970s. However, at that stage it was decided that power requirements alone were too great to warrant further consideration. (It is generally regarded that a signal of 500 to 1000 μV at the input of a small portable receiver is required to give a good quality broadcast signal in a noisy urban environment. Such a signal level can only be achieved by a geosynchronous satellite transmitter with a power output of around one quarter of a megawatt!)

If the power requirements can be met there are some definite advantages (and also some disadvantages) to be had from a space-based shortwave transmitter. For it is the very frequencies that are useless for ground originated, ionospherically reflected signals that can propagate from space, through the ionosphere, to the ground. Consideration of exactly what these frequencies are involves both an interesting physical and geometrical problem, and also helps to quantify the discussion into actual system parameters.

Upon reflection

When a swept frequency signal is directed from the ground vertically toward the ionosphere there is found to be a critical frequency, f_c, which separates the behaviour of the signal. Frequencies below f_c are reflected by the layer in question, whereas frequencies above f_c pass essentially undeviated through the layer. If the signal is not vertically incident upon the ionospheric layer, the maximum frequency, f, that is then reflected is given by

$$f = \frac{f_c}{\cos i}$$

where i is the angle that the signal makes with the normal to the layer (Figure 1).

In actuality, the reflection of an oblique radio wave by the ionosphere is a gradual process; see Figure 2(a). As the wave penetrates into the ionised layer, it encounters a greater density of electrons which cause the wave to be progressively bent or refracted.

If the wave frequency is not too high this refraction leads to the equivalent of reflection. If, on the other hand, the frequency is too high to allow reflection, it will travel past the level of maximum ionization and be refracted back onto a path parallel to the original incident wave. This is shown for an idealised homogeneous ionospheric layer in Figure 2(b).

Note that the transmitted ray is parallel to, but slightly displaced from, the projection of the incident ray. This displacement increases with the thickness of the refracting layer and also as the wave frequency ▶

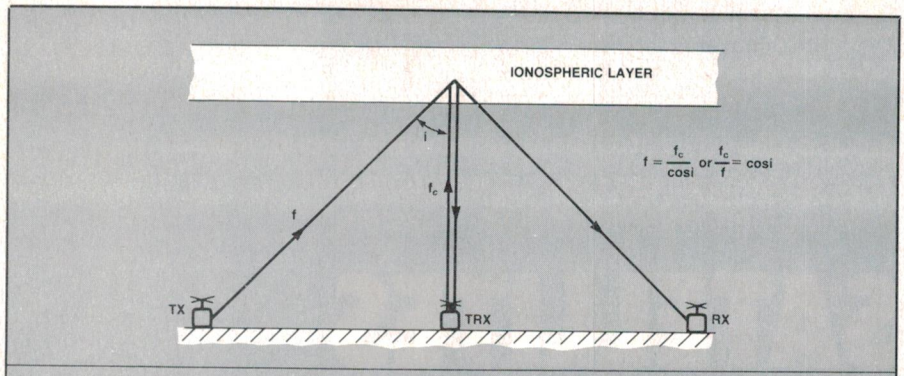


Figure 1. Relationship between an ionospheric layer critical frequency, f_c (vertical incidence), and the maximum frequency, f, that may be transmitted at an oblique incidence angle, i.

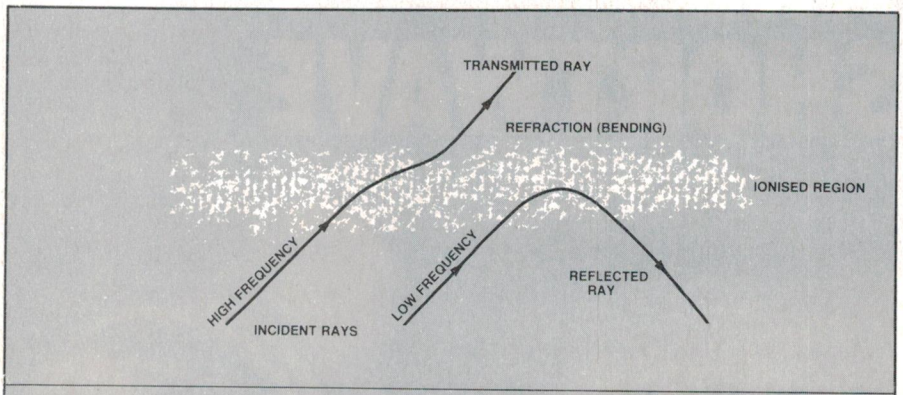


Figure 2a. Process of refraction within an ionospheric layer may lead to reflection (low frequencies) or transmission (high frequencies).

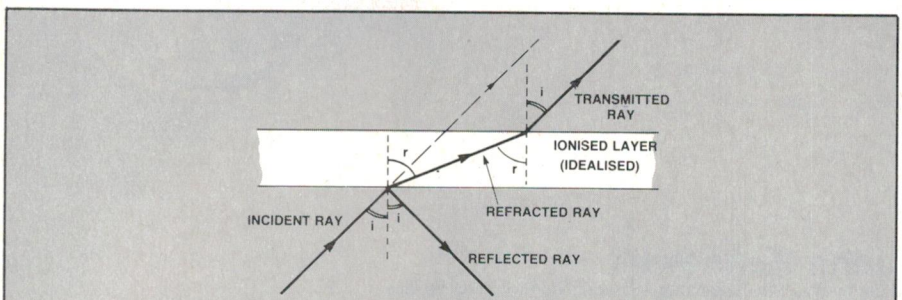


Figure 2b. An idealisation of the process showing the angles involved. Note that the transmitted ray is parallel to the incident ray, but displaced a small amount.

approaches the oblique critical frequency. It is assumed to be negligible (and in practice is negligible for high orbit satellites) in the following discussion.

The sky's the limit

In applying the above points to a signal propagating from a satellite to a receiver on the ground we simply invoke the principle of reciprocity. That is, if the transmitted frequency is too low, it will be reflected by the ionosphere back into space. The problem reduces to finding the minimum frequency, for any given path, above which the ionosphere wil appear transparent to the satellite signal. All discussions will consider only satellites located well above the ionosphere.

From the time of the first Sputnik, the Soviets have been using frequencies near 20 MHz, and more lately 15 MHz, for telemetry purposes. These satellites, however, usually orbit *within* the ionosphere and their signals are subject to ducting which can result in reception at their antipodal points. This phenomenon is quite complex to analyse, is not very predictable, and thus will not be considered here.

The geometry relating to the satellite-to-ground propagation path is shown in Figure 3. The transmitted signal strikes the ionospheric layer at point I with an incidence angle of i. It is this angle together with the critical layer frequency, f_c, at this point that will determine whether or not the satellite signal, f, will pass through to the ground station. Unfortunately, the angle i is not something that is readily available for computation. What is required is an expression relating the minimum transmittable frequency, f, to the distance 'a' that the ground station, E, lies (measured along the ground) from the satellite sub-point, P.

With the aid of some trigonometry this can be done to produce a satellite HF propagation equation. The equation, including its derivation (for those interested) is given in the accompanying box. To be useful, however, the implications of this equation need to be presented visually.

Before looking at some tabular results from the satellite HF propagation equation, it is useful to consider the portion of the earth's surface that can be seen by satellites at different heights. This is shown in Figure 4. The limit of satellite optical visibility is given both as an angle measure along a great circle path, and a ground distance along the same path. The actual distance appropriate to radio frequencies will be somewhat larger due to refraction effects by the Earth's surface. This can be generally simulated by using a value for the Earth's radius, R, that is 4/3 the actual value of 6370 km.

Some results

Using the values of Figure 4, the satellite equation may be used to compute minimum propagable frequencies within this area. This is done in Table 1 opposite.

All computations were done assuming that the principal ionospheric refracting layer was 300 km above the surface. This layer is the F2 layer in the daytime, and the F layer at night. It is interesting to note that although the lower altitude satellites have a more limited ground coverage, the lowest frequency that can be employed at the edges of the area serviced is 3.4 times the ionospheric critical frequency at the point of penetration. This number is independent of satellite height. It is obvious, of course, that a wider range of frequencies may be used by the higher satellites to service stations within the coverage area.

An alternative presentation of data is shown in Figure 5. This shows the minimum useable frequencies for a satellite in geosynchronous orbit, assuming a uniform ionospheric layer at 300 km with a critical frequency of 10 MHz across the hemisphere. This is, of course, not realistic but it serves as a first basis for discussion. In actuality the critical frequency is determined in a good part by the angle that the Sun's rays make with the point in question.

The critical frequency is thus highest for the point directly below the Sun and falls off on either side longitude-wise, and also with latitude. Ten MHz is a good approximate value for the maximum critical frequencies experienced at times of moderate sunspot number (e.g: R=50), rising to around 15 MHz or higher when the sunspot number is high (e.g: R=150). These values will occur directly at the sub-solar point.

If, at a particular time, this was to be coincident with the sub-satellite point, the contours of Figure 5 would be correct for the central part of the graph, but would be more open at greater angular distances. This change, reflecting the diminished critical frequencies away from the sub-solar point, would also mean that the last contour (around the limit of the visibility circle) would also be at a lower frequency (e.g: 20 MHz).

P is the satellite sub-point, the point on the Earth's surface immediately below the satellite.
S is the satellite transmitting the signal (at height h)
E is the ground receiver
I is the point at which the signal passes through the principal ionospheric refracting layer (at height d)
R is the Earth's radius
The minimum frequency that can be propagated from S to E is given by $f = f_c \cos i$ where f_c is the ionospheric critical frequency at point I. Any frequency lower than this will be reflected back into space.

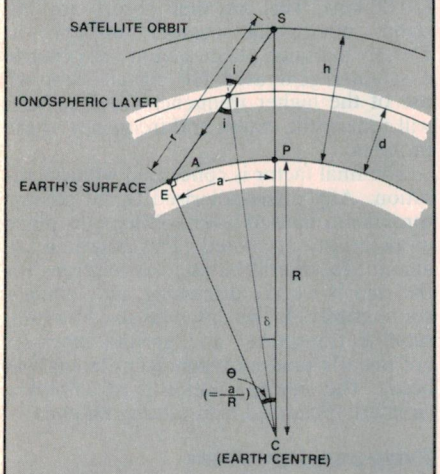


Figure 3. Geometry for signal propagation from a satellite to the ground.

SATELLITE HF PROPAGATION EQUATION

The geometry of the satellite propagation path is shown in Figure 3. The problem is to find the minimum frequency that will propagate from the satellite at **S** to a ground receiver at **E**, a distance **a** from the sub-satellite point **P**. The ionospheric critical frequency at **I** is f_c.

In triangle **CSI** the rule of sines yields $\frac{R+h}{\sin i} = \frac{R+d}{\sin \varnothing}$

Similarly, in triangle **CSE** we have $\frac{R}{\sin \varnothing} = \frac{r}{\sin \Theta}$

The above two equations combine to eliminate $\varnothing$ giving $r = \frac{R(R+h)\sin\Theta}{(R+d)\sin i}$

The cosine rule in **CSE** also gives $r^2 = (R+h)^2 + R^2 - 2R(R+h)\cos\Theta$

Equating the two expressions for r, the satellite to receiver distance, gives

$$\frac{\sin^2\Theta}{\sin^2 i} = \left(\frac{R+d}{R}\right)^2 + \left(\frac{R+d}{R+h}\right)^2 - \frac{2(R+d)^2}{R(R+h)}\cos\Theta$$

The incidence angle **i** is related to the frequencies f and f_c by the relation

$$\sin^2 i = 1 - \cos^2 i = 1 - f_c^2/f_2$$

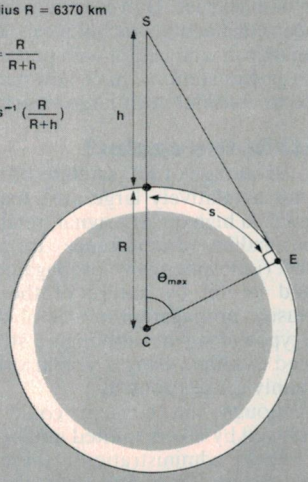
Thus the above equation can be rewritten:

$$\frac{f_c}{f} = \sqrt{1 - \frac{\sin^2\Theta}{\left(\frac{R+d}{R}\right)^2 \left\{1 + \left(\frac{R}{R+h}\right)^2 - \frac{2R}{R+h}\cos\Theta\right\}}}$$

Now $\Theta = a/R$ and if we let $\alpha = \frac{R}{R+h}$ and $\beta = \frac{R+d}{R}$ we have the final form of the satellite HF propagation equation:

$$\frac{f_c}{f} = \sqrt{1 - \frac{\sin^2(a/R)}{\beta^2(1+\alpha^2) - 2\alpha\beta^2\cos(a/R)}}$$

Earth's radius R = 6370 km
$s = R\Theta$
$\cos\Theta_{max} = \frac{R}{R+h}$
$\Theta_{max} = \cos^{-1}\left(\frac{R}{R+h}\right)$



h(km)	Θ_{max}	s(km)
1000	30°	3200
2000	40°	4100
5000	56°	5300
10 000	67°	5900
18 000	75°	6150
36 000	81°	6300

Figure 4. The maximum portion of the earth's surface that can be seen by a satellite of altitude 'h' km.

Θ° \ h	1000 km	2000 km	5000 km	10 000 km	18 000 km	36 000 km
0	1.0	1.0	1.0	1.0	1.0	1.0
10	1.6	1.2	1.1	1.0	1.0	1.0
20	2.8	1.9	1.3	1.2	1.1	1.1
30	3.4	2.8	1.7	1.4	1.3	1.2
40		3.4	2.4	1.8	1.5	1.4
50			3.2	2.4	1.9	1.7
56			3.4	2.8	2.3	1.9
60				3.1	2.6	2.2
67				3.4	3.1	2.6
70					3.3	2.8
75					3.4	3.2
80						3.4
81						3.4

Limit of visibility

TABLE 1. f/f_c values for various satellite heights h (km) and various ground ranges Θ°. (Θ is the angular distance from the receiver to the sub-satellite point). The ionospheric layer is assumed to be at 300 km.

If the sub-solar point was to the left of the diagram, the central left contours would be unchanged but the ones to the right would be spread further apart. An egg-shaped pattern would result with the 'fat' end of the egg on the right or eastern side of the hemisphere.

Factors affecting

Apart from shielding of the satellite signal by the F-layer there are three other factors to be considered. The first one of these is the phenomenon of sporadic-E. At certain times of the day during the summer months, patchy intense regions of ionization form at around the 100 km level. This sporadic-E can occasionally have such a high critical frequency that, in effect, blankets the F-layer from ground signals (Figure 6).

A satellite signal that passed through the F-layer might very infrequently be blocked by such ionization. Because of the irregularity of this phenomenon, it has been estimated that, in the worst case, a 26 MHz signal transmitted from geosynchronous ▶

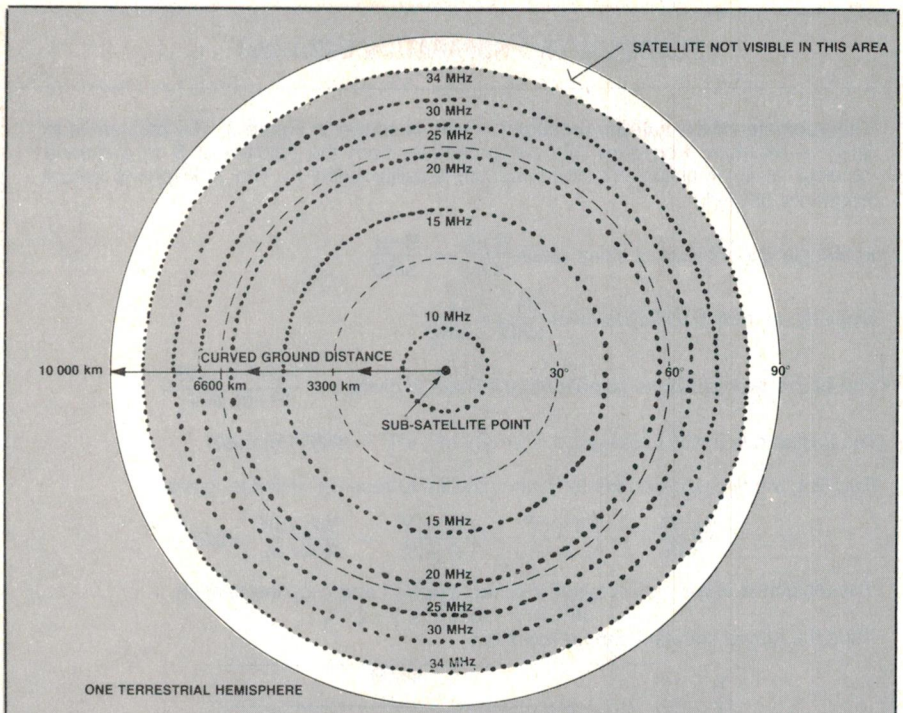


Figure 5. Contours showing the minimum frequencies that will propagate from a geosynchrous satellite (h = 36 000 km) to a ground station. The ionosphere is assumed to be homogeneous with a critical frequency of 10 MHz (this would certainly not be the case in actuality).

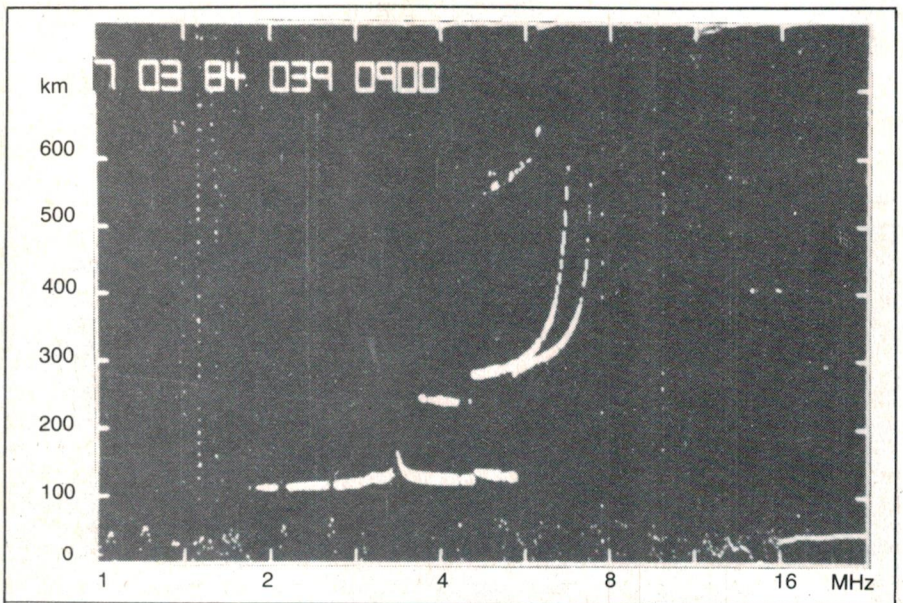


Figure 6. An ionogram showing 'blanketing' type sporadic-E. The higher F region echo at 300 km is obscured by the lower sporadic-E layer at about 5 MHz.

Operating frequency	26 MHz
Modulation type	AM (A3)
Transmitter power	16 kW
Antenna gain	40 dB
Antenna size (diameter)	500 metres
Antenna beamwidth	2°
Signal received by a receiver with a simple dipole or whip antenna	500-1000 μV
Received power	−78 dBW
Receiver noise environment	−122 dBW
Signal-to-noise ratio	44 dB

Figure 7. USA proposal specifications for a geosynchronous sound HF broadcasting system.

orbit should be shielded for no more than 5% of the time. This would only apply at certain times of the year in selected geographical locations.

The second factor to be considered is shortwave fade due to solar flares. This normally occurs to a signal propagating from a ground-based transmitter via the ionosphere. When a large solar flare occurs, the increased X-ray emission from the sun causes intense ionization of the D-region (50-80 km). This can then absorb any HF signal attempting passage through it. Exactly the same phenomenon will occur to a satellite generated HF signal, although use of the higher frequencies i.e: 26 MHz will reduce the extent and frequency of the problem.

The final factor is concerned with polarisation. Any plane-polarised signal passing through an ionised layer will have its plane of polarisation rotated. This rotation can amount to several hundred revolutions for the signals we are discussing, and changes continuously. If the antennas used by both satellite transmitter and ground receivers are linearly polarised significant fading will occur. The simple solution is to employ a circularly polarised transmitting antenna.

Proposed system

Figure 7 gives details of the satellite HF broadcasting system which has been proposed by the USA. It is significant to note that it still requires 16 kW of transmitting power. The required antenna gain also limits (because of its directionality) the area that can be serviced. The massive size of the antenna, one-half a kilometre in diameter, would appear to be not a feasible proposition to construct. However, new lightweight space constuction techniques, developed primarily in connection with potential space solar power stations, have now made it possible to consider such large structures.

Within the realm?

The advantage of HF satellite broadcasting is that a relatively large area may be serviced by a high quality signal, relatively free from fading. Interference from ground based (ionospherically propagated) signals would be nil by nature of the mutually exclusive propagation modes of the different types of signal (although a strategically placed satellite, using a similar orbit, could certainly cause problems).

Although the concept could only be employed by a very limited number of present world administrations, these are the same nations currently emit the greatest number of HF transmissions. Translation of these transmissions to higher, and currently little used, HF broadcast bands would do much to alleviate current shortwave congestion.

Studies conducted show that the 26 MHz band should be useable for satellite broadcasting at most times. When solar output is low, the useable bands might extend through 21 and 17 MHz to as low at 15 MHz. One may well ask why the 88-108 MHz FM broadcast band has not been suggested for a similar type of satellite broadcast service. Although there are some associated technical problems, I believe the answer lies more in the political arena. ●

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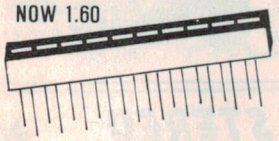

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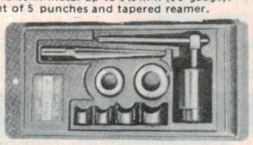

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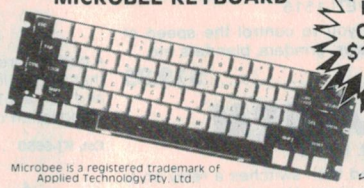

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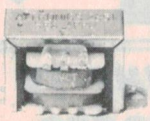

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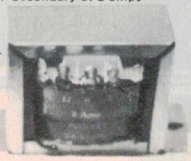

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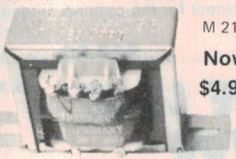

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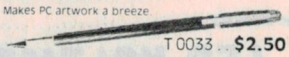

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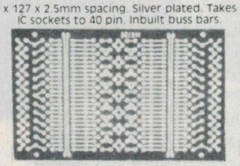

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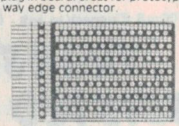

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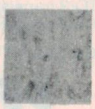

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Ref: EA September 1982

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Cat. KA-1109 ..... $15.00

TEMP. PROBE ★

Ref: ETI June 1983

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Ref: EA March 1982

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Cat. KA-1420 ..... $74.50

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Cat. KB-4031 ..... $19.95

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Ref: ETI 084

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Deluxe kit with many features including: 10 amp output relay, accessory loop, horn relay and headlamp output, auto alarm disable etc. Great value.

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A contact breaker triggered reactive discharge system that will fit all 12V negative earth vehicles utilising coil and contact breaker ignition. Gives the most efficient combustion of air/fuel ratios.

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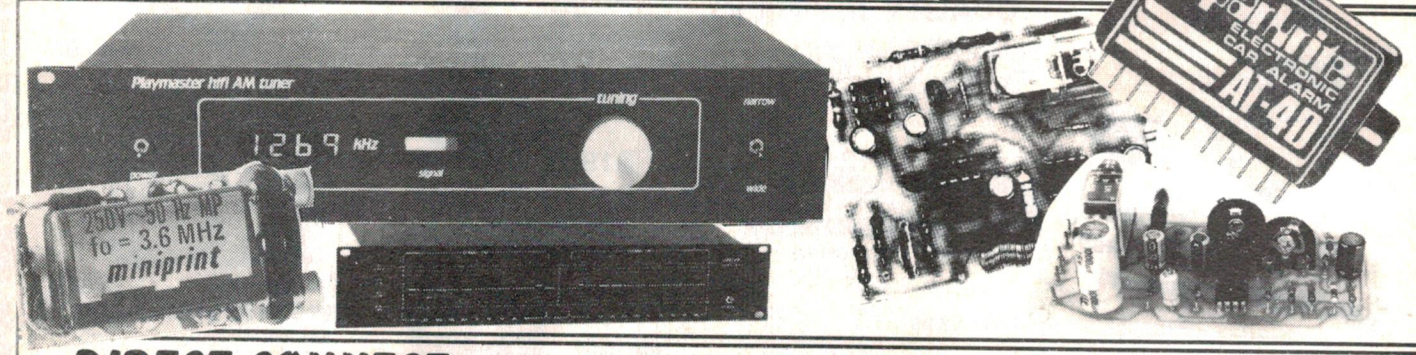

DIRECT CONNECT MODEM

Ref: ETI 644 October 1982

This unit is a full duplex auto answer/auto originate unit. An incredible array of features including selectable Baud rate, software controlled etc.

Cat. KB-4600 SHORTFORM - PCB plus all components $169
Cat. KB-4602 FULL KIT - in case with optional audio monitor and signal strength meter $199

12V 300mA Plugpack to suit - Cat. MP-3010 $9.95

TRANSISTOR ASSISTED IGNITION ★

Ref: EA January 1983

Latest version of this popular kit - includes die cast case, TO-3 transistor covers etc. Beware of kits supplied with flimsy sheet metal boxes!

Cat. KA-1506 ..... $35.00

DELUXE EPROM BURNER ★

Ref: ETI 668 February 1983

Plugs into the Microbee I/O port and enables you to save programs in any of 5 different EPROMs (2716, 2732, 2532, 2732A & 2764). Deluxe kit includes 5 "Personality" plugs, case, front panel, mains transformer, fuse, 240V plug etc. plus 2 sockets with extra long pins and extra components for 2764 programming.

Cat. KB-4651 ..... $55.00

TELEPRINTER (TTY) INTERFACE

Ref: ETI 672 October 1983

Adapt cheap 2nd hand teletype machines to a low cost computer printer with this kit. Includes all parts excepting a 240/110V transformer which is available.

Cat. KB-4672 ..... $13.95

UHF - VHF TV CONVERTER ★

Ref: ETI May 1981

This kit will convert a UHF signal either from a TV station or from a UHF VCR down to an unoccupied VHF TV channel. Kit contains all parts except for the optional vernier and tuning gang.

Cat. KB-4552 ..... $32.50

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Ref: ETI 724

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Cat. KA-4019 ..... $35.00

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Ref: ETI 268 March 1982

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Cat. KA-1400 $16.95

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Ref: EA September 1982

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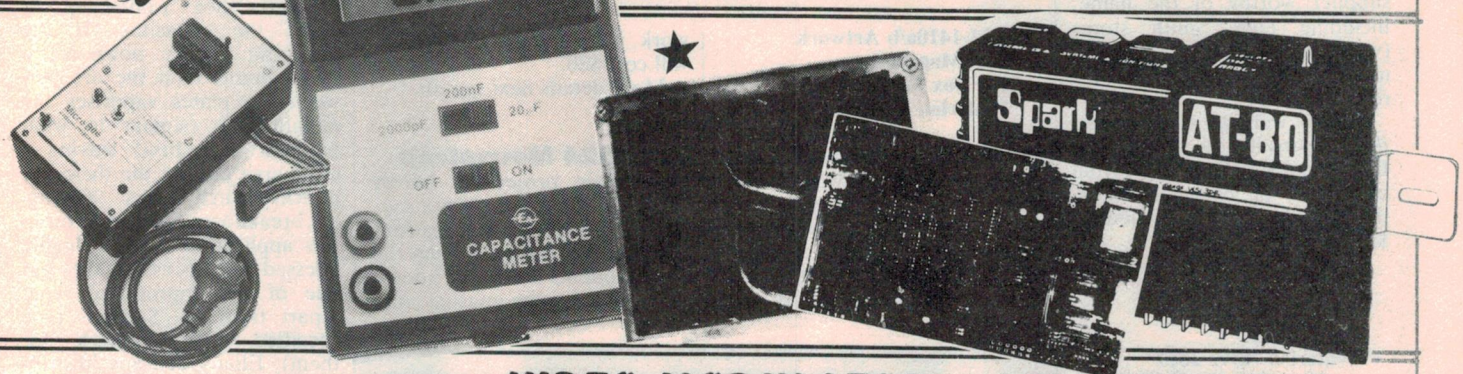

PARALLEL PRINTER INTERFACE

Ref: ETI October 1983

Allows you to connect your Microbee to a printer having "Parallel" or "Centronics" input. Kit includes R/angle DB15 plug.

Cat. KE-4671 ..... $15.00

Centronics plug to suit Cat. PP-0890 $14.95

VIDEO MODULATOR

Ref: ETI 760 October 1981

High stability (low drift) unit designed to give good RF drive to colour TV's. A must if you're using your colour TV with a computer.

Cat. KE-4554 ..... $17.95

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Ref: ETI 471 June 1979

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Cat. KE-4022 ..... $47.90

LOUDSPEAKER PROTECTOR

Ref: ETI 494 October 1982

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Cat. KE-4023 ..... $18.50

GRAPHIC EQUALISER 2010 MK IIA

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Cat. KJ-6535 ..... $139.00

GUITAR BOOSTER

Ref: EA June 1982

Inexpensive preamplifier enables you to use your guitar with your own home Hi Fi system. Complete kit supplied and it runs on a safe 9V battery.

Cat. KA-1450 ..... $17.50

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Ref: EA October 1982

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Cat. KA-1480 ..... $5.00

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Ref: EA Dec/Jan 1982/1983

The Playmaster AM Tuner is a true broad bandwidth superhet design kit. Excellent performance plus Jaycar's usual excellence in kit presentation.

Cat. KA-1498 ..... $249.00

ALIGNMENT KIT FOR ABOVE TUNER

Ref: EA February 1983

This simple module generates 2 spot frequencies (600 Hz and 1300kHz) and buffers your multimeter. Enables you to align the Playmaster AM tuner.

Cat. KA-1515 FREE WITH ABOVE KIT .. $7.95

SUBWOOFER AMP

Ref: EA July 1982

100W rms drive capability coupled with low-pass filter and MOSFET technology. Amp will take line level (1V) or can be connected directly to sub-woofer speaker.

Cat. KA-1452 ..... $79.00

"VOX RELAY"

Ref: EA April 1982

This voice operated relay (VOX) can be used to turn on tape recorders or transmitters and of course turn them off. Use with high or low impedance microphone or high level line input.

Cat. KA-1432 ..... $14.50

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ETI-807 Tug-O-War

Good practice for the games arcade *aficionado!* Great amusement for wet, wintery weekends. Components for this project are generally readily obtainable. Unlike you'd expect, Dick Smith stores *don't* stock all the parts. You'll be able to buy all the LEDs and some of the ICs from D.S.E., but not the 74154, 74LS193 or 74LS123. The pushbuttons, switches and mechanical etc parts are stocked by virtually every electronic components supplier worthy of the name, including Dick Smith stores (we've given D.S.E. catalogue numbers in the parts list for reference).

If you want to make *everything* yourself and wish to use film transparencies of the front panel and pc board artworks, then the set can be obtained for $8.00 post paid from:

ETI-807 Artwork
ETI Magazine
PO Box 227
Waterloo NSW 2017

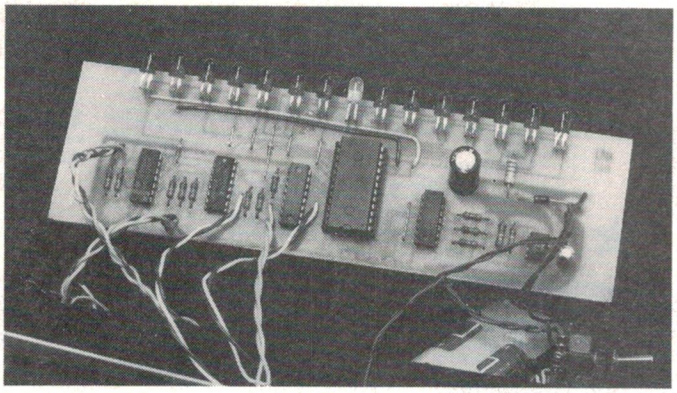
Make sure, when ordering, that you ask for positive or negative film, according to what your photoresist requires. Make out your cheque or money order to 'ETI Artwork Sales'.

Kits for this project may be stocked by **All Electronic Components** and **Rod Irving Electronics**, both in Melbourne.

ETI-1410 Bass Guitar Amp

The complete project construction will be finalised next month. All the components are pretty well off-the-shelf from most electronics retailers, with the exception perhaps of the potentiometers. We used 16 mm diameter types with standard 6.5 mm shafts. These are distributed by Soanar, known as "V16L" types. Standard 23 mm diameter pots may be used, but the pc board cannot then be directly attached to them. The connections will have to be made using short lengths of tinned copper wire.

Printed circuit boards should be available from the usual suppliers. If you're making your own, then film transparencies of the artwork for the ETI-1410a and b boards can be obtained for $7.00 from:



ETI-1410a/b Artwork
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PO Box 227
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Make out your cheque or money order to 'ETI Artwork Sales' and ensure you specify positive or negative film, according to what your photoresist requires. If you want to wait till next month, a complete set of artwork, including the front panel, will cost $20.

More details next month.

ETI-1524 Mousetrap

While this project is hardly likely to stem the plague currently sweeping the eastern states, it will certainly clean the rotten rodents out of the house.

There are some unusual components in this project, but with a little resourcefulness, you should be able to locate them. The 2μ7/400 V (250 Vac) capacitor needs to be mains-rated, metallised poly or mylar type. 'Greencaps' of this value and rating (or even 630 V) are available, though we specified a Siemens type B32231. These types of capacitor feature a self-healing action should a 'punch-through' occur in the dielectric between the 'plates', which consist of a very thin layer of metal deposited on the dielectric film which is then 'wound up' to make the capacitor. If the dielectric breaks down at a stress point, then the arc between the plates vaporises the metallisation (similar to what happens in a fuse) leaving a clear area around the dielectric punch-through, thus 'healing' the breakdown. The capacitor in this application is quite highly stressed, so it is essential to get one of the appropriate type. Apart from the Siemens type specified (try **Promark** for them), Elna greencaps (distributed by **Soanar**) may be used, or Roederstein MKP series (distributed by **Mayer Krieg**).

The MR856 fact recovery diode is not a common component with electronics retailers. However, it is a Motorola part, distributed by **VSI**. Ask your favourite supplier if he'll get some in.

The RCA-made SCR (Q3), the S2600M, is distributed by **AWA Microelectronics**. In Sydney, try **Semikron** in Burwood or **Geoff Wood** Electronics in Rozelle. The C122E (by G.E.) or TIC126E (by T.I.) may be substituted. All the other semiconductors are bog-standard everywhere, as they say.

The ferrite aerial rod used for the core of T2 is stocked by Dick Smith (cat. no. L-1401), amongst others. It's not really critical, providing you use something of similar dimensions.

If you're making your own pc board, you can obtain a same-size **photostat** of the artwork by sending us a stamped, self-addressed A4-sized (same size as the magazine page) envelope. Address it to:

ETI-1524 Artwork Photostat
PO Box 227
Waterloo NSW 2017

If you want a same-size film transparency of the artwork, to ▶

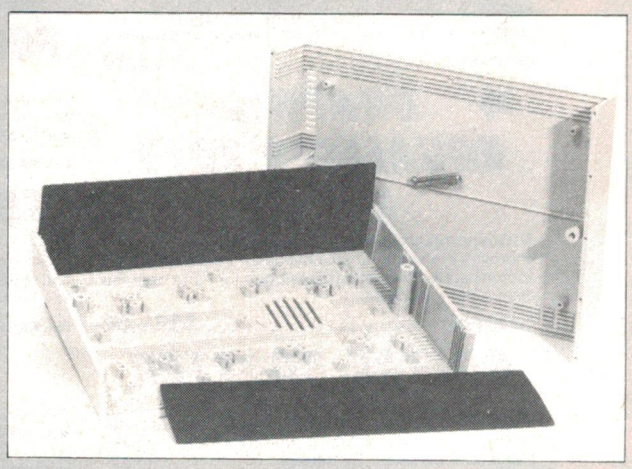
NEW 'DELUXE' INSTRUMENT CASES

This swish-looking new instrument case from Perth-based Altronics Distributors continues the line of "Jack-Tec" boxes introduced by the company last year.

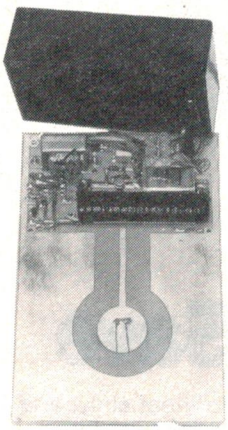
This model is larger than the earlier model. Overall, it measures 260 mm wide, stands 85 mm high and is 190 mm deep. The usable height of the front and rear panels is 73 mm which allows mounting common meters like the Minipa MU45 or University TD66, etc. A speaker vent on the base allows direct mounting of a standard 57 mm (2¼") speaker.

Internal mounting posts enable a wide range of pc boards and transformers to be accommodated. Guide rails for pc boards are also provided internally to allow vertical positioning of boards at several locations. The front and rear panels are removable and feature a textured finish on one side, smooth the other. This enables direct engraving or screen printing on the plain side.

The top and bottom split apart, as for the earlier model, and extra plastic or aluminium front and rear panels are available. Four rubber feet are moulded into the case bottom. Full details from **Altronics Distributors, Box 8280, Stirling St, Perth WA 6000.**



SHOP AROUND



use directly with your photoresist, then you can obtain it for $10 post paid by sending a cheque or money order, made out to 'ETI Artwork Sales', addressed as follows:

ETI-1524 Mousetrap
Artwork Film
PO Box 227
Waterloo NSW 2017

Make sure your specify whether you want a positive or negative to suit the photoresist you'll be using.

Kits for this project may be stocked by **All Electronic Components** and **Rod Irving Electronic** in Melbourne.

ETI-738 25 W UHF Booster

We have been advised that **Dick Smith Electronics** will be stocking this project as a kit. **Geoff Wood Electronics** in Sydney has the individual parts in stock. Geoff is the source supplier of the SRF1078/2N6136 Motorola RF power transistor used in the project.

Project pricing

We have been advised that, in recent issues, our project pricing has been a little on the low side. We base our price estimates, and that's all they are — **estimates**, not "official" or "recommended" prices, on the latest catalogues or price lists obtainable at time of going to press. However, as there is some 6-8 weeks delay between when the prices are calculated and when the magazine appears in the newsagents and shops, cost and component price movements in the meantime can, and have, markedly affect our estimates. **Please don't blame your supplier** if his price is above our price estimate shown in the project parts list. Nobody's trying to "rip you off".

We're currently pushing our project price estimates up by 10-12% at the time they're calculated, just to cover the situation, which can only be described as 'fluid'.

Ready-made pc boards

You can obtain ready-made pc boards, and sometimes front panels, from the following suppliers:

All Electronic Components
118 Lonsdale St
Melbourne Vic 3000

RCS Radio
651 Forest Rd
Bexley NSW 2207

Acetronics
112 Robertson Rd
Bass Hill NSW 2197
(02)645-1241

Billco Electronics
Shop 2, 31 Pultney St
Dandenong Vic 2175

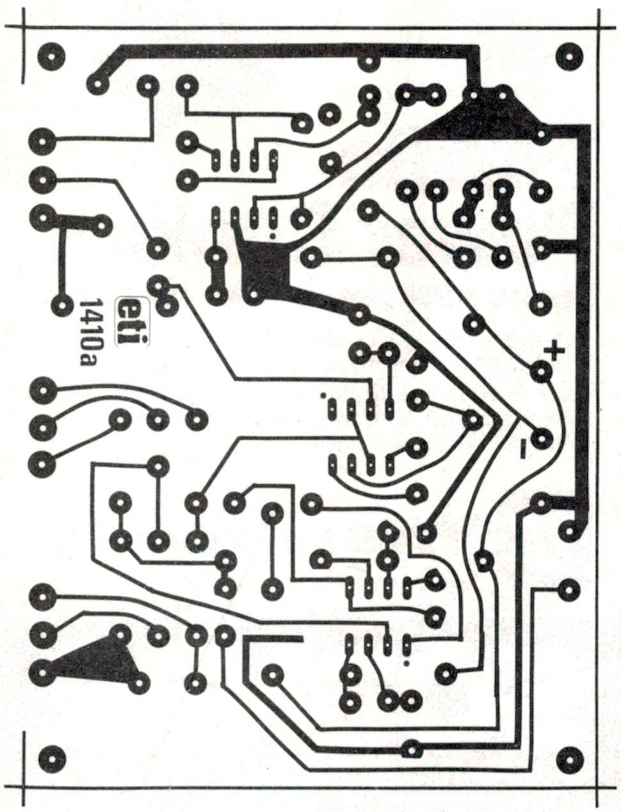
Jaetronics
58 Appian Drive
St Albans Vic 3021

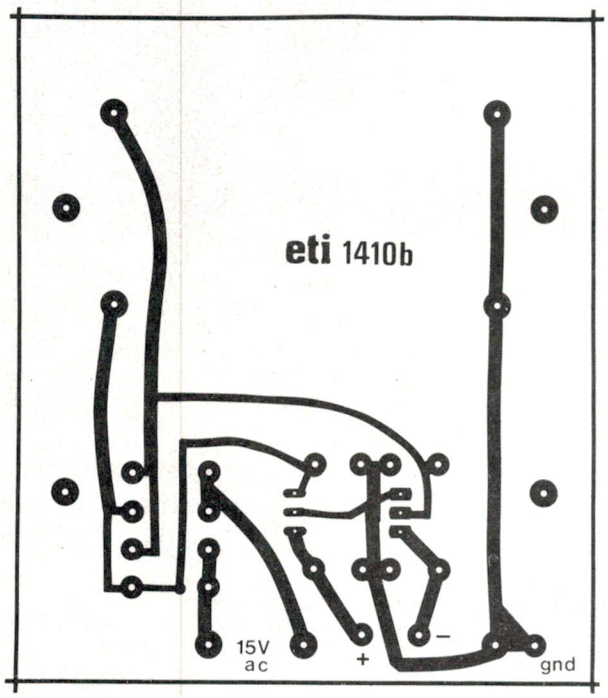
Jaycar
117 York St
Sydney NSW 2000

Jemal Products
PO Box 168
Victoria Park WA 6100

Mini Tech
PO Box 9194
Auckland NZ

Rod Irving Electronics
425 High St
Northcote Vic 3070





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- Very compact and reliable
- Self starting one-second stepping motor has strong torque
- Powered by 1.5V AA battery that lasts for one year
- Supplied with two sets of hands, one short and one long
- ±15 second/month accuracy
- 56mm square, 15mm deep

Complete with data sheet, instructions and wall hanger bracket.
Cat. XC-0100

JAYCAR JVE-1 VIDEO DETAIL ENHANCER

SPECIFICATIONS:

- Maximum enhancement not less than +8.3dB @ 2MHz
- Enhance disabled (Bypass) response, DC to 5MHz −0.5 +1.0dB
- Colour subcarrier 0dB notch frequency, tunable to 4.43-MHz. −/+0.5dB, all settings
- Amplifier group delay, less than 0.075uS.
- Signal handling capability not less than 1.35 volts p-p. (Sync. is clipped first)
- Power 12V AC @ 100mA
- Controls: ON/OFF, ENHANCE, ENHANCE/BYPASS SWITCH CORE/GAMMA CONTROL
- Input connector, RCA socket
- Output connector, RCA socket x 3

DESIGN FEATURES:

- A unity gain notch at the colour subcarrier frequency, whose purpose is to prevent chrominance to luminance errors at high enhance levels.
- A closed loop configuration with lead tag compensation to achieve stable, well defined gain.
- DC coupling, eliminating large capacitors in series with the video signal and achieving DC response for applications requiring it.
- Low output impedance prior to termination resistors, enabling up to three outputs to exist and be used or left unterminated.
- A level dependent closed loop response or Gamma control ('Core').
- Clip on negative going signals at −67 volts into 75 ohms to prevent sync. errors owing to overshoot.

Cat. AV-6501

$69.95

12 Volt AC plugpack

Cat. MP-3020 ..... **$16.95**

NEW - MOTORCYCLE INTERCOM $39.95

(Ref: EA March 1984)

Now you can talk freely and safely to your pillion passenger with this handy kit!
Cat. KA-1533

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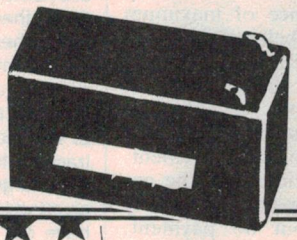
Cat. SB-2483 ..... 6 volt 8A/H **$18.95**
Cat. SB-2486 ..... 12 volt 5A/H **$29.95**



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$4.95 ea
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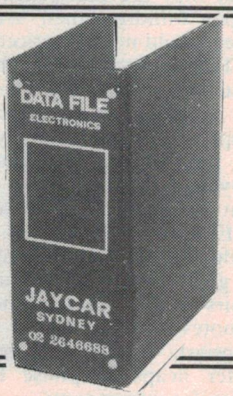

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Volume One

A potpourri of application notes and tips for the Microbee Personal Computer

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WILDCARDS VOL. 3 - Another in the series of Wildcard books with even more in Vol. 3. Large section on assembly language using a game as an example with an assortment of business programs, utilities and graphics.
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WILDCARDS VOL. 2 - A continuation from Vol. 1 - again a must for all Microbee owners.
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microbee

INSIDE CP/M - A GUIDE FOR USERS & PROGRAMMERS - This is one of the most informative books on CP/M available and is commonly referred to as the "CP/M Users Bible". Divided into 2 sections. One being a tutorial including set up operation of CP/M, the other being a quick and easy reference guide to CP/M. A must for all CP/M users.
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INFRA-RED MOVEMENT DETECTOR

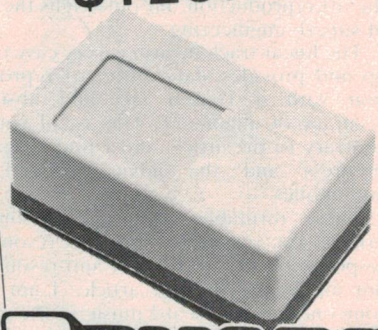
The infra-red or IR detector for short, falls into the Black magic category. It basically is a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna?) which has a "Commutated" field of view. Its reception pattern is comb-like, but highly tuned to the IR wavelength of human bodies.
When a human passes within proximity of the pickup area, the lens will selectively pick up IR radiation and then not. Movement across the pickup area will result in a series of pulses sent to a detector circuit.
IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects. Curtains, for example, can wave about without tripping the alarm. Even the cat is unlikely to trip the unit.
The "Arrowhead" is the latest of a series of IR detectors that we have sold. It represents the latest developments.

FEATURES:

- 12V DC powered
- Small 4½" x 2" x 1½"
- Double sensor
- Computerised OC to lower failure rate
- Built in test lamp
- Tamper switch included
- Alarm output SPST 30V DC @ 1A

Cat. LA-5017

$129.50



Jaycar ELECTRONICS

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LETTERS

Fee for service

Dear Sir,
I am an electronics enthusiast who, like many others, has turned a hobby into a profession. But, unfortunately, I have to make a living out of it.

Other professionals, such as medical practitioners and lawyers, have built up a mystique over the years. An appointment has to be made well in advance and any problem requires more than one visit. These professions have standard fixed fees, no under or overcharging.

The GP's work is only clerical in nature but they have convinced the community that they are indispensible. If electronics types withdrew their services for a year they would not be noticed.

Trades, such as plumbers and washing machine servicemen, charge fees like $80 as a minium and undercharging does not happen; plumbers simply do not turn up to jobs without the chance of maximum payment. If you do not believe this, find out the charges for yourself.

Electronics repairmen, the part of our industry visible to the public, do not make a good living. Many customers seek repairs without intending to make payment. Quotes result in wasted time. For the enthusiast, 'friends' seek repairs and usually offer heaps of praise but no payment, even for components.

Most electronics people are weak and introverted. They may have interesting work but they will not get anywhere, especially if they (we) do not know how to charge for services!

L. W. Brown
Burwood, Vic

Linear tracking T/Ts

Dear Sir,
In ETI, Dec 1983, the article which reviewed six linear tracking turntables stated that the cost of engineering these turntables far outweighs the benefits.

I have owned conventional turntables but now own a Sony linear tracking turntable and find that the benefits of these turntables, and the ease of obtaining state-of-the-art reproduction, far outweighs the cost of superb engineering.

The linear tracking arm is very easy to set up and provides state-of-the-art reproduction with a Denon 305 and absolute accuracy of alignment. This is, of course, contrary to the article and I find it against progress and the advice needed by audiophiles.

These turntables are very reasonably priced. The reason for low, low resonance response on the Sony is an anti-resonator, not mentioned in your article. I am sure someone has not heard music in the state-of-the-art.

R. B. Manson
Launceston, Tas.

I agree with your sentiments that when the Sony linear tracking turntable is properly set up, as yours undoubtedly is, it obviously provides you with an extremely good performance. However, the words I used and their specific intent were a little different from the abbreviated statement in your letter.

My measurements and observations showed clearly that for a linear tracking turntable to exceed the best performance of a pivotted tone arm turntable requires sophisticated engineering. I can only justify such complexity when it achieves improvements and performances that the less complex system is unable to provide. While the best of the systems came close to providing such improvements, the less expensive ones did not.

It is obvious that linear tracking turntables are being promoted by marketing personnel as a new gimmick to improve sales. However, they have only achieved the following attributes:

1. The low cost linear tracking turntables are undoubtedly neater, smaller and more functional than conventional pivotted arm turntables. These units do not appear to offer any significant improvements in technical performance as a result of the change to the 'linear tracking' principle.

2. The more expensive examples of the linear tracking turntables are more attractive, exciting and generally larger than the conventional pivotted tone arm turntable. Our investigations have not shown that their technical performance is significantly improved in either trackability or in reduced distortion.

Louis Challis
Kings Cross, NSW

Questions on CD

Dear Sir,
I am a regular reader of your excellent magazine and find it very interesting.

I thought I would point out a few errors in the article on compact disc players published in ETI, February 1984 on page 37. It is stated that the Technics SL-P8 is the first unit from Technics. This is incorrect as Technics released the SL-P10 well before the SL-P8. Perhaps the SL-P10 was not sold in Australia but it was certainly available in New Zealand prior to the SL-P8. Australia may have been behind NZ in compact disc players.

the other error that I thought I would point out is that the SL-P8 is provided with a remote control unit. If the writer of the article had taken the trouble to read the instruction book he would have seen that the remote control unit is a standard accessory of the SL-P8.

S. J. Jepson
Otaka, NZ

Thank you for your letter regarding the CD players review in the February '84 issue of ETI. However, I wish to take issue with your criticisms. Firstly, the SL-P8 was the first player *released in Australia* by Technics. The SLP-10 was not released generally here, according to the information supplied by National Panasonic Australia. I personally saw one, and had a demonstration, at the Technics factory in Osaka, in Japan, in July 1982, and subsequently wrote a news item on it in the August 1982 issue, page 117. At the end of this item I said "No date has been set for the unit's release in Australia". In fact, it was not released. Undoubtedly, units were obtainable at some outlets, but likely not purchased through National Panasonic here. Hence, the SLP-8 was the *first* Technics CD player released here. I might add that this information was included because that was the position given to us by Technics!

As regards the remote control, I draw your attention to page 41, Feb. '84 issue, centre column, second last paragraph. ". . . from a remote control unit *which was not supplied with the unit we received.*" Our reviewer, Louis Challis, noted that an infrared remote control *was* available for the unit, but that *we did not receive it.* He *did* take the trouble to read the instruction book, as he *always* does, however, you did not take the trouble to read the article closely enough.

I trust you continue to find ETI excellent reading.

Roger Harrison
Editor, ETI

More Mac

Dear Dregs,
You're right — Mac Rame will have you in knots until someone explains it is a special string command for use in networking.

Mac Rame should only be used with the Mac Kerel software which forms a trap for any data stream that looks a bit fishy.

Mac Indoe is another useful routine; it sets the pitch for computer generated sound effects. For the Scots there is a special export grade called MacCrimmon[1] for use with the electronic bagpipes (recently seen on ABC-TV).

And speaking of the Scots, rumour has it that there will be an erasable ROM supplied for this market under the description Mac Clean. Apparently there is still further work to be done on the Mac Abre effect associated with erased ROM.

In the communications field high hopes are held for Mac Ula, an applications configured system for predicting sun spot activity.

The oil exploration industry is eagerly awaiting the correction of a little slip in the application package Mac Assar, which has resulted in vast reserves of hair oil.

Incidentally, I tried to teach your April Dregs to a neighbour's parrot that used to scream all day "Polly wants an Apple"; now it sits silently on its perch, over-Mac-Awed!

Now wouldn't that give you the Mac Pip! — a condition worse than finding a bug in your Apple.

Keith R. Groom
Oakleigh Sth, Vic.

(1) For details of Mac Crimmon see 'Oxford Companion To Music', under 'Bagpipes'.

MINI-MART For Sale/Wanted/ Swap/Join

AUDIO

TED: Reel-to-reel tape deck, 4 or 8 track. Groenhout, 25 Kerferd St, Watson ACT (062)412-316.

SALE. INSTRUMENT SPEAKERS HP 38 cm 8 cm $25, $50 for both. Also one Albicord elephone answering machine $20. Chris (03)459-6141.

SALE. CONCRETE SPEAKER BOXES. Two only to suit ETI Series 4000/1, 4-way er project. These are the actual units ibed in July 1981 issue, $450. Gareth ngton, 11 Moldavia Walk, Osbourne SA (08) 248-1406.

COMPUTERS

SALE. MICROBEE 32K IC $460 ono. Soft- good condition. 64K ROM board $70. bee ROM $30. J. Magnussen, 28 Chorley Cheltenham NSW 2119. (02)86-1653.

SALE. MICROBEE 32K with 4 MHz conver- black and white monitor, cassette deck, bee, manual and tapes, only $450. Phone 5-6480.

SALE. MICROBEE 32K, 4 MHz. EDASM, Denshi Green monitor, Joystick, chess, K. Lau, 7 Jindaless Place, Killara NSW (02)498-7270.

FOR SALE: ACT VIC-20 bimonthly magazine. Many interesting articles and programs. August issue $2. Bimonthly $12 per year. Chris Groenhout, 25 Kerferd St, Watson ACT 2602.

WANTED. REPLACEMENT COPIES of bundled software for Kaypro 2 damaged while moving. Write to Box 337, Kingcote SA 5223. (0848)2-2631.

FOR SALE. SUPER 80 ASSEMBLER $15, dis-sassembler $9. Vintage new receiving and ham radio valves. Send SASE for types and prices. R. Vowels, 93 Park Drive, Parkville Vic. 3052.

WANTED. VIC 20. Working condition unex-panded model. Will consider other peripherals and software. Must be realistically priced. Brown. P.O. Box 5451, Cairns Qld 4870.

FOR SALE: TANDY 3-6-9 V solar cell $5. Tandy MC-10 computer $75. ETI-660, colour, 3K RAM $80. TI59 programmable calculator $50. B. Begg, 18 Sturt Ave, Toorak Gardens SA 5065. (08)31-0310.

FOR SALE: MONITOR, b/w portable deluxe, 12 inch CRT, excellent condition. Asking $100. Contact E. Brover, 8 Pentlowe Avenue, Lower Tempelstowe Vic 3107. (03)850-1090.

FOR SALE. DGZ80 CPU $100, ETI-640 VDU $80. 32K static RAM $150. 12K BASIC ROM PCB $80. Power supply, ten-slot motherboard and case $90. L. Donkin, P.O. Box 135, West Mackay Qld 4740.

ATTENTION VZ200 users. Would you like to be on my data base mailing list? It is a sort of mail based club. John D'Alton, 39 Agnes St, Toowong Qld. 4066. (060)371-3707.

SWAP PERSONAL COMPUTER. User group urgently seeks other enthusiasts. Please write for information on this newly established national club. John Paulic, P.O. Box 79, Gosnells WA 6110. (09)398-6303.

FOR SALE. S100 BOARD. Ithaca Audio Z80 CPU $70. WMC MEM-Z 16K RAM $60. DG640 VDU $80. (03)584-4749. W. R. Crowther, 52 Wallingford St, Cheltenham.

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COMMUNICATIONS

FOR SALE. FACSIMILE transceiver, Rank Xerox 400 complete with Telecom attachments, hand-book, paper. In good condition and working order. $800. 8 Beagle St, Darwin NT 5790 (089)81-2761.

WANTED: TIME MARK GENERATOR and copy of radio and electronic laboratory handbook by Scroggie and Johnstone. David, P.O. Box 316, Manly NSW 2095. (02)938-3417.

MISCELLANEOUS

FOR SALE. 150 volumes of EA and ETI from 1976 to 1982. Most in plastic binders. Russell, (052)43-0741.

DREGS

WE HAVE BEEN exercising our minds on mouse traps for the last month or so, and no doubt you will have seen the results of this strenuous deliberation in our article on mouse dispatching. Didn't it strike you as somehow comforting to know that, at the heart of all the hi-tech'ery was the most low-tech of baits, a mouldy old bit of cheese?

But the Japanese are about to change all that. (Now you know how the Swiss watchmakers felt when someone first said "digital" to them). It seems that one Yosuke Watanabe, from the Ikari research labs has discovered that what rats love most is other rats. What is more, one rat knows where the other rats are because they all emit an ultrasonic whistle on 24 kHz. Ain't mateship wonderful?

The above facts all came to light when Watanabe was trying to find out why rats are attracted to computer installations. The problem has got worse in recent months because Japan has been experiencing a rat plague. (No cats). In fact, things are getting so bad that it is estimated that one computer failure in three in Tokyo is now caused by rats either eating through cables or urinating on connections.

A solution to the problem has not been long in forthcoming. Ikari plan to build an upmarket version of our project in this issue. It will have an ultrasonic transmitter tuned to 24 kHz, which will attract the rats, a vacuum cleaner that will suck them off the floor, and finally a gassing and disinfection station where the *coup de grace* will be administered. The idea is that the contraption would be built into the building to completely protect the computer.

At least ours is cheaper.

Pass the pintpot

It's not only in Tokyo that they're having problems. New York hosted the conference of the American Association for the Advancement of Science (AAAS) recently. It seems that a real problem has been detected at the conference.

The Hilton hotel, where the conference was held, has decided to introduce plastic beer mugs. Now anyone unfortunate enough to have drunk from one of these monstrosities will know that (a) the beer tastes awful and (b) they don't weigh as much as your ordinary common-as-grass glass tankard.

The second of these is a problem because it means that experienced drinkers have a lot of trouble knowing how much anti-gravity force to apply to the plastic glass when addressing the beer to the input port. If you're lucky, you wind up dribbling down the front of your shirt. If you're unlucky, you splash the guy behind. If you're *really* unlucky, the guy behind is a seven foot gorilla with a squint!

It appears that the British press corps, who descended on the AAAS conference *en masse* had just such a few incidents, which caused quite a few un-scholarly moments. No wonder Ronny and Maggie have so much to chat about.

A 'wetwork'?

Finally, it's good to know we aren't the only people in the world who suffer from the dreded typo. They're the bane of this industry. Recently we learned, for instance, that the Dulmont Magnum, that most portable of Australian macro computers, is to be sold in the US via a 'newtwork'. That's a network of web-footed computer salesmen.

Why have they got webbed feet? From splashing about in bars serving beer in plastic tankards! ●

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At altitude, the radar capability of the F/A 18 Hornet enables it to look down over the curvature of the earth's surface and see targets far beyond normal radar range.

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The two decks utilise Yamaha's unique Linear Electromagnetic Transduction system which extends linearity to the point where the signal is transferred from the head to the tape–a previously uncontrollable area in the recording chain.

High performance features on both decks also include dbx and Dolby-B* noise reduction, ORBiT (Optimum Record Bias Tuning), a microcomputer controlled Linear Counter, expanded range level meters and a number of auto memory functions.

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Your Yamaha dealer can show you the full range of Yamaha Cassette decks starting at around $200. If you'd like further information just complete and post the coupon below.

K-1000

K-2000

*Dolby is the registered trade mark of Dolby Laboratories

I'd like further technical information on the new K-1000 and K-2000 cassette decks.

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